A System Dynamics Based Analysis of "Rank and Fire" Management Policy

By

Thomson David

M.S., Computer Science, 1989
Wayne State University

B.S., Electrical Engineering
Kerala University, India

Submitted to the System Design and Management Program
in Partial Fulfillment of Requirements for the Degree of

Masters of Science in Engineering and Business Management

AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, FEBRUARY 2002

Signature of Author _____
Thomson David
System Design and Management Program

Certified by _____
James H. Hines
Senior Lecturer, Sloan School of Management
Thesis Supervisor

Accepted by _____
Steven D. Eppinger
Co-Director, LFM/SDM
GM LFM Professor of Management Science and Engineering Systems

Accepted by _____
Paul A. Lagace
LFM/SDM Co-Director
Professor of Aeronautics & Astronautics and Engineering Systems

A System Dynamics Based Analysis of "rank and fire" Management Policy

By

Thomson David

Submitted to the System Design and Management Program in Partial Fulfillment of Requirements for the Degree of Masters of Science in Engineering and Business Management

Abstract

Most major US companies have employee performance evaluation systems that have been around for decades. Such evaluations have been used to reward employees for their performance, but a new policy of "rank and fire" has been introduced to the process in some corporations. Managers are asked to rank every employee, best to worst, in each department. Those at the bottom are often heavily penalized and, in some cases, fired or demoted. For example, some corporations require that managers place their employees into three ranked categories with a strict quota of 10%-80%-10% or 20%-70%-10% of employees in each category. Employees in the lowest performance category do not receive merit raises or bonuses for that year. Two consecutive lowest ratings will lead to demotion or termination. The pros and cons of the practice are currently being debated in terms of its effect on motivation, morale, and the demographics of the company. The present work is intended to better understand some of the structures behind the "rank and fire" employee evaluation management policy and help management assess and improve policies around its initiative.

A system dynamics model was developed to represent the "rank and fire" employee evaluation policy. A group of employees of "Company A" were interviewed for the current employee evaluation method and associated concerns. A standard system dynamics process of listing variables, creating causal loops, building and simulating models was adopted. The interviews were aimed at obtaining the key variables of concern and generating momentum solutions. Emphasis was placed on the fears and hopes for the future. Causal diagrams captured the mental models, or dynamic hypotheses, of why such behaviors could occur. Dynamics arise from the interaction of multiple loops. A particularly troublesome set of feedbacks was selected for closer study via computer simulation and the effect on employee morale, staff level, results and productivity was developed. Analysis of the model provided guidance for recommending better polices. Intended effects of the policy versus the actual effects of the policy were examined. Momentum solutions were collected at the beginning of the project. The desirability of these solutions was considered at the end of the project in light of the analysis. The effects of increasing, decreasing or eliminating the quota were analyzed. Recommendations include a more efficient management of quota allocation and a better reward system. The morale and firing factors were studied. Finally, the study suggested further areas of research.

Advisor: James H. Hines
Senior Lecturer, Sloan School of Management

Acknowledgements

I would like to thank the administration of the System Design and Management (SDM) program at Massachusetts Institute of Technology. I appreciated the opportunity to learn and grow from the interaction with the MIT faculty, SDM support staff and SDM colleagues. I will always cherish this experience.

I am especially grateful and thankful to my wife, Sarasu, who gave me all the support to this effort. This thesis, and the course work, took time and energy, and caused anxiety and frustration. It took me away from home, for weeks and months, and caused me to work late in night, for work and school. Still, she encouraged me when I needed it. I am grateful to my children Edwin and Alwin for their understanding, support and encouragement during the course of this program.

I wish to express my sincere thanks to my advisor, Professor Jim Hines. He introduced me to this fascinating world of system dynamics. I greatly appreciated his guidance, inspiration, wonderful insights, patience, and unique sense of humor throughout this thesis. In spite of his very busy schedule, he has always managed to make time to help me out with any problems.

Ford Motor Company supported this thesis, through its participation as a partner in the System Design and Management program at MIT, and particularly to the Vehicle Dynamics department of Global Core Engineering. I am grateful to Will Boddie, and Chris Magee, who have championed Ford's association with SDM. I am indebted to Greg Stevens, and Dan Craig for nomination into the SDM program. I am especially thankful to Greg and Dan for their continued support over the past two years as I disappeared to Cambridge at what seemed to be the worst possible times. I want to thank my staff from Lab Testing and Methods Section for their support and understanding during the course of this program.

I would like to thank all the members of the organizational evolution team at MIT.

And finally, I would like to thank my parents, family members, and all my friends for their understanding and encouragement for completing this program.

Table of Contents

List of Figures and Tables

Chapter 1: Introduction

Motivation

The ability to measure and reward the performance of managers and business units is critical to organizations of all kinds. Most major U.S. companies have an employee performance appraisal system that has been around for decades. When a performance evaluation scheme is used to communicate expectations about job context and goals of performance, we can assume that the objectives will be an explicit part of the expectations against which managerial performance will be measured.

Employee evaluation schemes are often criticized for being subjective and biased. But it is one of those policies that are needed to manage a large company. It is lot like wearing seat belts. Most people believe that they are necessary, but they don't like to use them. As a result, employee evaluations are criticized from all sides and are often used to satisfy some formal organizational or legal requirements. But these evaluation schemes are one of the primary ways to reward employees for their performance on the job.

New "Rank and Fire" Policy

Company A has instituted a new "rank and fire" management policy by evaluating employees on a bell-shaped curve. Under this policy, the employees' yearly performances are rated on an A-B-C scale with a strict quota of 10%-80%-10% respectively. Those at the bottom of the scale are often heavily penalized and, in some cases, fired or demoted. Employees with C rating will receive no merit raise and bonus. Two consecutive C-ratings will lead to termination. Many employees are concerned that the new process will hurt morale and productivity.

To become the world's leading consumer-focused company in its field business, Company A, is trying to introduce good products that customers want and try to be the employer of choice to attract the best talents in the industry. To that end, Company A has overhauled its incentive structure, hoping to improve productivity and the quality of its products. Historically, incentives

have been in the form of salary increases and merit bonus. Company A believes that providing significant performance-based incentives is an important part of leading the company through the 21st century. The new plan is a pay-for-performance incentive plan. This plan provides no bonus for individuals who do not contribute to the corporate objectives and provides multiple bonuses for those who contribute significantly. The system is based on ranking employees on a strict quota basis, which evaluates the individual's capabilities in managing people and their performance, against the outcomes or results. At the same time that the pay-for-performance incentive plan has gone into place, the method of evaluation and metrics has changed from being developed on a local basis and linked to the individual, to being driven by corporate goals and linked to the organization. One of the key reasons for this change is to focus on individual and team performance to create a high performing and more competitive organization. The company thinks that the new evaluation setup will strengthen the link between compensation and performance rating by providing an incentive system that will attract and retain the best talents within Company A.

This practice of employee appraisal into ranked categories has become a controversial policy in recent years. Some think it's good, and others think it's bad. For example, some people believe that this policy makes a structured and effective employee evaluation scheme so that top performers are rewarded appropriately and low performers are identified early, given extra coaching and training, to improve themselves up to the expectations of the company. Others believe that there is unfairness and bias in this practice and that managers know the precise performance level of each employee, and that this sort of ranking is really a subjective judgment that depends on many factors. The pros and cons of the practice are currently being debated in terms of its effect on motivation, morale, and the demographics of the company.

Hopes and Fears of the New Process from SDM Students

Many SDM students, who have had industry experience ranging from 3 to 25 years or more, had a chance to discuss this new policy on an electronic discussion board. Some had direct experience with similar policies and others had their own opinions about the new policy.

Following are comments from the students about promoting the top 10% and penalizing/firing bottom 10%:

- I am concerned that it will deteriorate teamwork as people try to "pass the hot potato", and strangle innovation, since people will not want to fail, or take any chance that they might fail and increase stress (which is already high).

- The bad aspect is that people are really on edge trying to Figure out what it takes to not get a zero. The zero rating adds more uncertainty to an already subjective rating process. A positive side effect is that employee-supervision communication is improved. However, the zero performers are usually readily apparent within the organization. An increase in employee separation through attrition is a usual side effect.

- Company C did this for one year about eight years ago. What a disaster! Everyone viewed it as strictly a way to lower costs (less money to employees). It was in total conflict with other company messages (we only want to hire the best people, we care about people, etc, etc.). After one year, upper management concluded that distributing pay raises on bell-shaped curves sounded good in theory, but did not make for good policy. (Forcing 10% of people to get no merit was a mistake. If they are that bad, just get rid of them! They're salaried and not union-represented people anyway, so what's the big deal?)

- Company D had a similar system, which graded employees as 5 (those who "walked on water") to 2 (similar to Company A's C rated employee) where repeated 2s were grounds for separation. It was judged as ineffective and abandoned about five years ago in favor of system similar to current company C's approach. I do not know all the specifics of litigation. I do know a few people sued the company after they were deemed to be "low" performers. Most of these people were older engineers who had a prior history of good performance ratings, and they claimed they were being discriminated against due to their age and their higher salaries (avoiding giving a 5% raise on a large base salary saved a lot of money and allowed for giving junior engineers larger raises). I do know of one or two

cases where the employee won in court or it was settled out of court (The finding/concern was that Company C was probably guilty of age discrimination). Morale went down especially for those recently promoted engineers (like Person B talks about in another posting) who suddenly found themselves at the bottom of the pack and thus getting 0% raises. Everyone realized pretty quickly that forced rankings based on a percentage of the salaried population and job categories was too inflexible, and middle/lower management people were the ones who eventually got that compensation system canned.

- In the late 1980's, early 1990's, when Company E was aggressively downsizing, they used a similar plan to decide who would get fired. Employees were ranked within the various engineering grades, and the lowest in each grade quit the company. This system backfired. Here's an example: If Joe Engineer was promoted from engineering grade n to n+1 the previous year, Joe is certainly on the low end of his new grade. So, here we have a really good engineer who just got promoted and is now ranked so low in his new engineering grade that he gets fired. This situation happened. This obviously encourages people to hide out and not take risk, which may well be the result at Company A. Why work hard and take risk in an effort to get promoted if your reward is to get fired?

- While my division also rates individuals 1 through 5, the typical phenomenon is "once a 5, always a 5," and "once a 1, always a 1". People generate reputations that may help/hinder their incentive return year after year. Company D has always had guidelines relative to how many people get a 5 rating and how many get a 1 rating. Theoretically, those getting 5's should get a premium raise, (i.e., 2x the average) and people getting 1's should get nil. However, managers typically have stood in the middle and tried to make everyone happy, thus giving something like 1.1x to 5's and 0.9x to 1's. The reason for giving 0.9 to 1's is that it results in minimal complaints. Giving somebody a 0% raise typically leads to several meeting with the HR department to defend the manager's position (too much headache). Giving 5's a 1.1x raise usually hasn't resulted in too much complaining since 5's typically aren't the types who whine to HR. In addition, 5's are typically rewarded by a somewhat faster promotion track.

This past year is one of the first times I have seen real enforcement of the "5s get 2x and 1s get 0" guideline. My opinion is that Company D was forced to take action to retain the 5's. Many senior 5's have left the company to go to the dot-coms.

- There was a little-known program a few years ago at Company E that was called the "refresh" program, where the bottom 5% of individuals were identified through forced ranking, and it was expected that at least the bottom 2% would be let go. Thus, anywhere from the bottom 2% to 5% could be let go every year. This would allow Company E to hire, and refresh the workforce. The same problem crept up around what happens when you are promoted and wind up at the bottom of your new peers. This only lasted a year or two and then was abandoned.

  I think these programs crop up for two reasons: 1. Managers and supervisors in big companies don't usually operate like they have P&L responsibility, and put up with poor performance (cause they don't want to be bad guys and fire people); and 2. The corporate legal system gets in the way of firing people (it can take up to two years at Company E). The theory wasn't that the bottom 5% or 2% weren't bad, just that they were at the bottom, and you could probably find better individuals. The problem with the program is that it is arbitrary. If you had one group that was head and shoulders above another group, the bottom of the first group might still be better than the top of the other group (big fish, little pond idea — sort of). You are better off running your groups like you are responsible for P&L, and getting rid of people who aren't contributing (again in theory, since the same problems still exist as mentioned above).

Some favored policies:

- Now, managers get so much money (percentage of total wages) each year to distribute. They decide the allocation based on individual performance. Some people may (rarely) get 0% but they usually are not here for long. They are put on performance improvement programs and let go, if they don't get better.

- A system similar to current Company C's, where budget-center managers get a pot based on headcount, which can be distributed from 0 to whatever the manager feels justified; however, there are guidelines for making sure diversity and balanced workforce goals are not jeopardized. This system, though more subjective, does give the manager more flexibility in rewarding pay for performance appropriately. In addition, managers do have the flexibility of awarding team awards. Grading employees did not work and inhibited teamwork.

- It is designed to pay for performance and gives the manager much more flexibility to reward performance within the allotted budget. It is also designed to be less punishment-oriented, though employees getting zero merit increases for performance reasons (there can be other causes for zero merit increases), would be prime targets for any reduction in force activity. The downside is reorganizations can create havoc with this system if teams are reorganized at higher frequency than the yearly review period. We do have informal midyear reviews as checkpoints, but cannot help if an employee is transferred to another group just before annual merit reviews.

- Not necessarily incentive to risk, but I can share with you how one of Company D groups works, rather innovatively, with respect to incentives. Given that the bell-shaped curve rating was abandoned within the company a few years ago, one group still uses it for providing subjective incentives. They leave the salary alone; however, the division agrees on a bonus plan before the start of the year. Let us say they decide on a 12% bonus for a given year considering certain business goals are met. These goals are then divided up to an individual level by negotiation with the employee to monthly and then subsequently to a week level. The division is very matrix-organized so the customer of an employee's output may or may not be within the group. That customer, the team and others will provide input to the employee's manager informally. The manager will then assign a 1 or 2 for a low performer and up to 5 for a high performer to the employee on a weekly basis. These weekly score will get racked up on a monthly level, which is used to prorate a 1/12th percentage, i.e., 1% of yearly salary (the bonus allocated for that employee) weighted by the performance score appropriately. This way, the bonus is trickled in to

every employee on a monthly basis, which is after the weekly performance rating of the weekly negotiated goals. For a consistent 5 performer, this can be up to 12% of that employee's salary over the year.

It sounds like the best of both worlds. Salary is maintained as well as performance is rewarded by the subjective incentive; however, measured more objectively, and risk due to sudden market conditions worsening, will have a lesser impact than the process, which hands out yearly bonuses.

Chapter 2: Loop Hypotheses and Reference Modes

One of the initial steps of the commonly accepted process for developing and using a quality system dynamics models is to identify the key quantities needed to be included in the model, for the model to represent and show the issues at hand. Oftentimes, identifying some of the key items is obvious, and sometimes it involves an extensive thought process if one has a clear understanding of the problem. An interview with potential customers helps to clarify the issue at hand and we developed potential key variables, as showen in appendix A. From those potential variables, we identified a few key variables and plotted those variables against time. Graphing a small number of variables enabled us to focus on the problem at hand, rather than try to attack the problem all at once. Also, the essence of the concern can, most of the time, be captured with just few key variables. These plots are called reference plots and they illustrate the concern by graphically describing key variables, behavior over time. We plotted the variables hoped-for as well as the feared behaviors. Figure 2-1 shows the company's concern that productivity will start declining in couple of years due to the adoption of a new employee evaluation system.

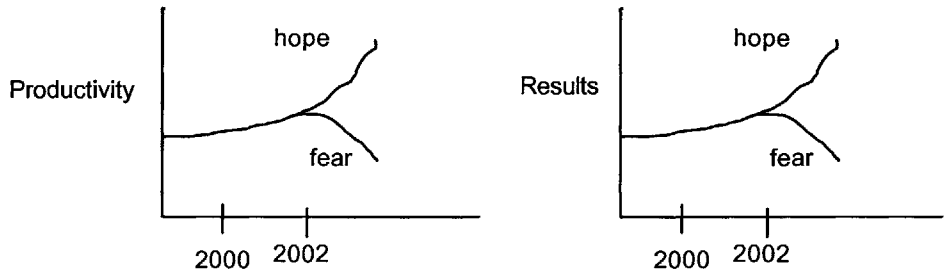


Figure 2-1 Reference Modes for Productivity, Results and Morale

But Company A's hope is to pursue the positive effect of the employee evaluation policy so that employees will work harder to increase productivity which, inturn, will increase the final results of the company. Similarly, in the same Figure, the reference mode for the results of the company is also shown. The hope is that results will improve as productivity increases. But the fear is that a decline in staff level will cause declining results.

As shown in Figure 2-2, the company is hoping that the morale of employees will increase, or stay at the current level since the company will consists of hard working, talented employees.

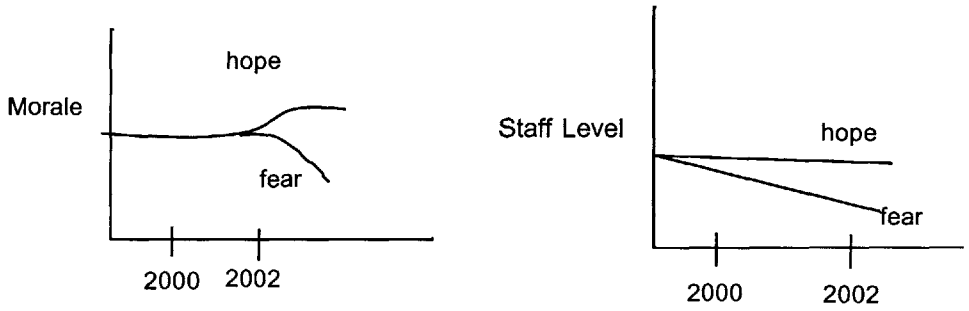


Figure 2-2 Reference Modes for Stress, fatigue and Staff Level

The evaluation policy will eliminate or weed out poor performers and discourage the lowest performing employees to stay with the company. But the fear is that morale will decline sharply due to fear of losing jobs, as well as anxiety and stress. Also, it is feared the staff level may go down since firing will eliminate too many people and a downward morale spiral will cause additional quitting but the company is hopeful that it will stay as stable as today, or for a gradual reduction of staff.

Chapter 3: Momentum Solutions

Momentum solutions are policies that we would consider implementing now as a way to correct the perceived problems. These solutions are already partially or fully in place or may not exist at all today. Some of the proposed momentum solutions likely to have a positive effect on company productivity, results, and morale include:

- Obtain data on relationships between C-ratings, firing, quitting and productivity.
- Determine the likelihood of circumvention by "rotating" the C-ratings or assigning them to those near retirement.
- Plan to increase or stabilize the C-quota over time so that low performers are always removed or discouraged.
- Plan to reduce the 10% C-quota over time, as current low-contributors are weeded out and higher-level contributors remain.
- Plan to remove the C-quota.
- Provide training to all employees to be aware of the process.
- Communicate the existence and importance of the new evaluation policy.

Dynamic Hypotheses

A dynamic hypothesis is a theory about what structures exist that generates the reference modes. At this point, we start investigating what may underlie the reference modes presented earlier. This will explain what structure is driving those behaviors. We express the hypotheses in words and find it useful and powerful to illustrate them with causal diagrams. Generally, a dynamic hypothesis corresponds to a structure that involves a loop or a set of loops. The dynamic hypotheses generated will be used to determine what will be kept in the models, and what will be excluded. In the following section we try to evaluate some of the specific dynamic hypothesis.

Rewards Motivates Employees

Rewards to employees are a strong motivating mechanism. The rewards can be of many forms such as bonuses, flexible time, time off, extra vacation, name recognition, etc. The motivation of employees has a huge impact on the productivity of the company. When employees feel good about their job and their company, they tend to work harder. This is captured in Figure 3-1. As Morale increases, Productivity increases, which causes Task Completion Rate to go up, which causes Results to go up, which causes Rewards to go up, which causes Morale to go up. This forms a positive, or reinforcing loop and it creates the basic idea of accelerating growth in the company.

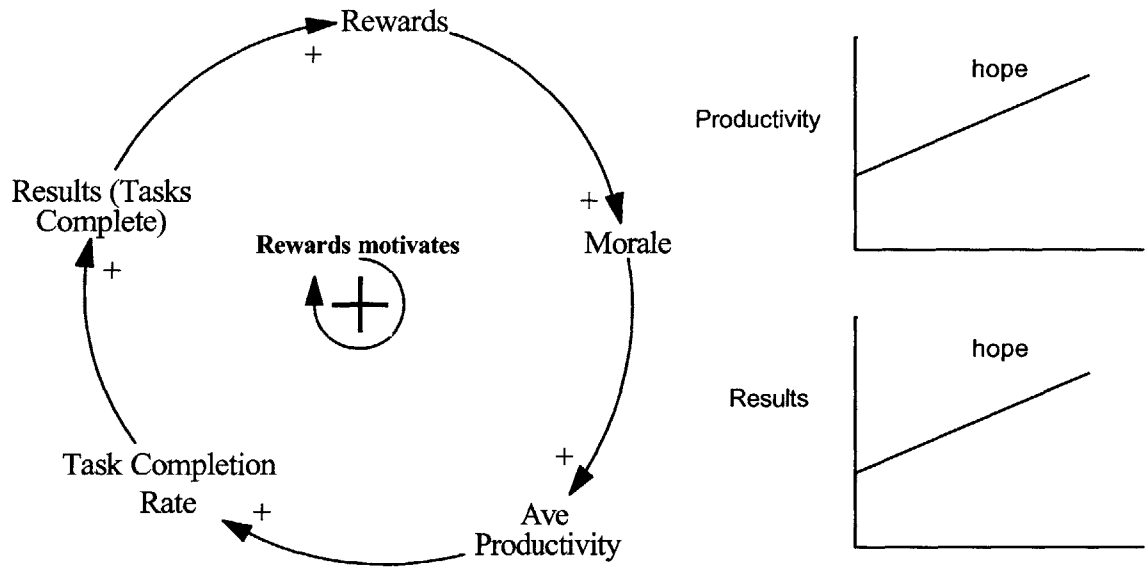


Figure 3-1 Reward motivation

Firing and Quitting Effect

The new policy creates a group of employees in the C category and it has an impact on the employees' decision to quit the company. Employees may feel insecure about their job and may decide to leave the company. This behavior is captured in Figure 3-2. As shown, C-Firing causes Staff Level to go down, which causes Task Completion Rate and Results to go down, which causes Rewards to go down, causing Morale to sink, causing Quitting to increase, again causing

Staff Level to go down. This is also a reinforcing loop. In this loop we are showing C-quota as an exogenous input the loop.

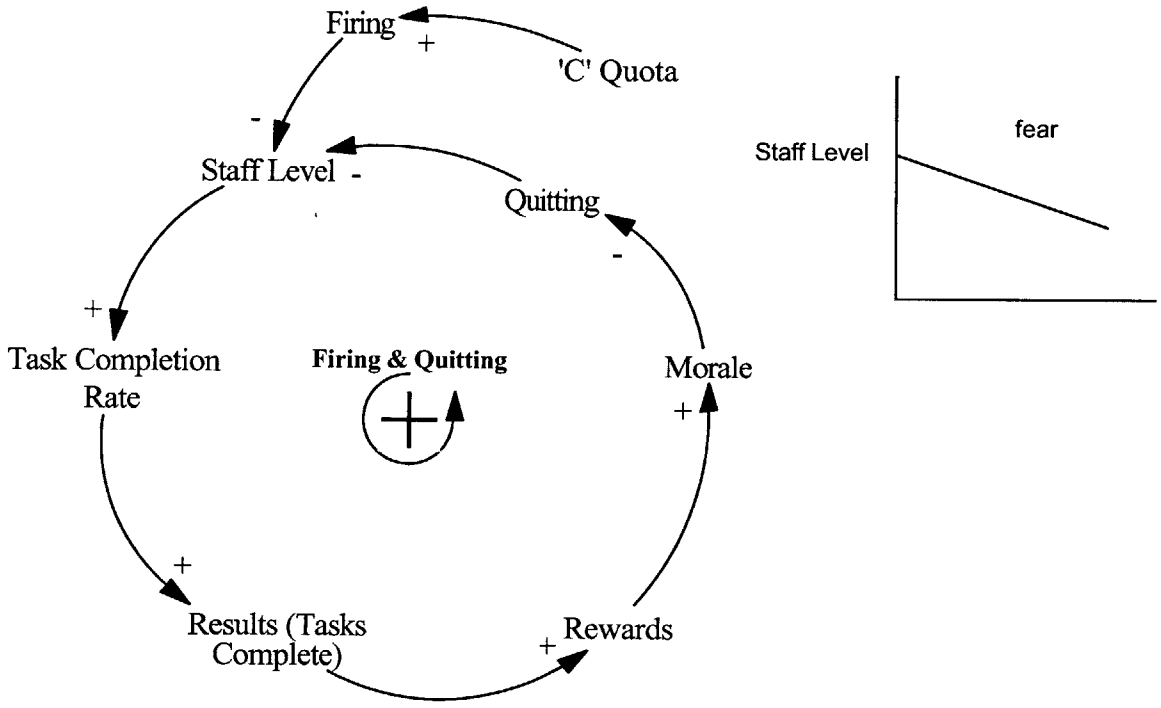


Figure 3-2 Firing and Quitting

C-quota Works

The "rank and fire" policy forces the ranking of employees into three categories. This categorization of employees has a huge impact on the company and its performance and, as stated earlier, the new process has many implications. When C-quota allocation is introduced, employees are fearful of receiving a lower ranking and its associated consequences. That makes employees work harder to avoid getting a C-rating. When employees work harder, productivity increases which, inturn, increases the results. This creates the perception that the quota system works and management either keeps the existing quota level or increases the quota. One such effect is the positive, or self-reinforcing loop shown in Figure 3-3, which illustrates the dynamic hypothesis that quota works to maintain or increase the quota. This formulation will help us

study the effects of one hypothesis to maintain (or increase) the quota, based on favorable results.

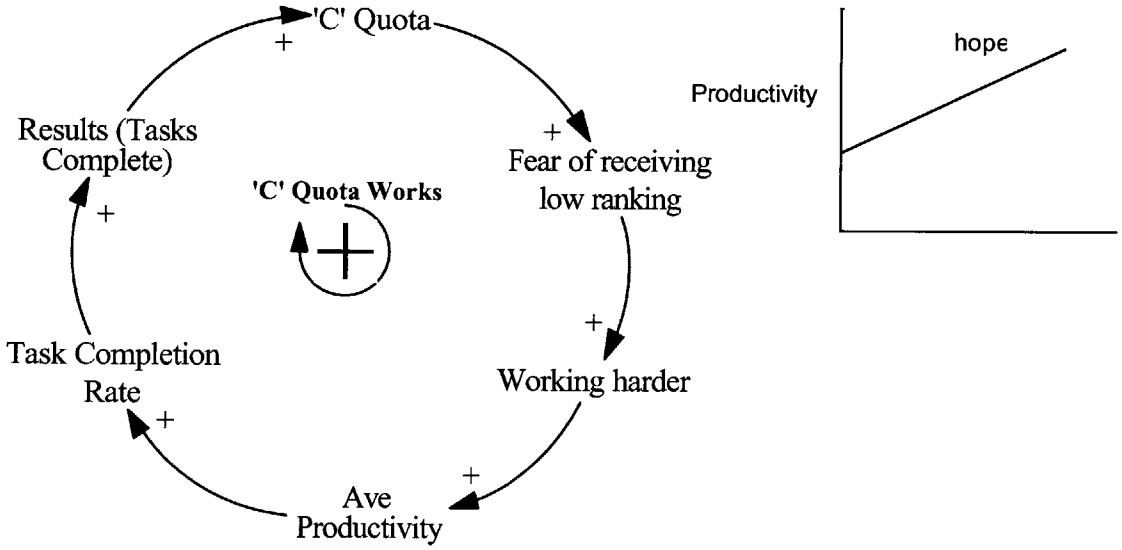


Figure 3-3 C-quota works

The Effect on Morale

When the quota system was introduced, the employees developed a strong fear of receiving a low ranking. Even though one may work very hard, the fact that the management has to meet a quota in each category, some employees are certain to receive a C-rating. This fear decreases the moral of the employees. The reduction in moral reduces productivity and the results of the company. This is explained using the negative, or balancing loop illustrated in Figure 3-4. These loops contribute to the feared reference modes.

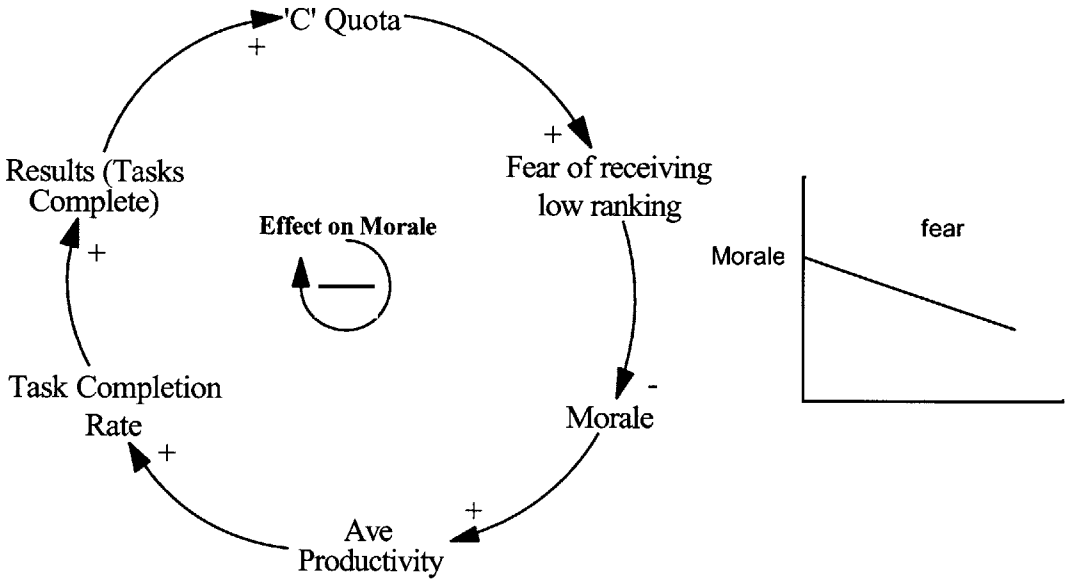


Figure 3-4 Effect on Morale

Quitting and Hiring Effect

When employees quit the company due to morale degradation, the staff level reduces and task backlog becomes larger, which reduces the morale. This is captured in Figure 3-5 by the quitting effect loop.

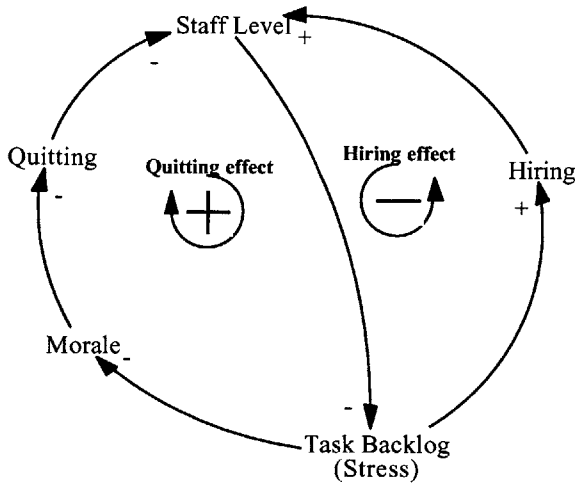


Figure 3-5 Quitting and Hiring Effect

Along the same lines, it is interesting to look at the effect of hiring on staff level. The hiring effect loop in Figure 3-5 shows a balancing loop. As hiring increases, the staff level increases, and when staff level increases, the backlog reduces, and when backlog reduces hiring reduces, etc.

Weeding Out Low Performers

The introduction of the new policy had many goals. One such goal was to reduce the workforce by removing the low performers. The lower ranked employees are fired to weed out the low performers from the company. This is illustrated in Figure 3-6. Even though firing reduces the workforce, it improves the morale of employees, since the company has weeded out the low performers, and the employees feel proud that the company now has achievers and productive workers. Better moral improves productivity and results.

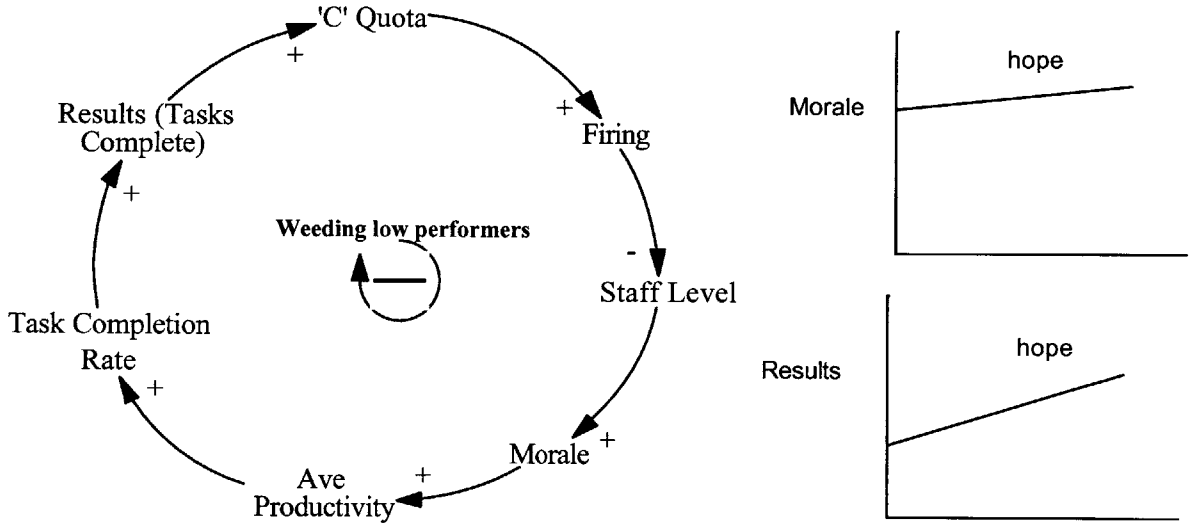


Figure 3-6 Weeding Out Low Performers

The Firing Effect on Staff Level

If employees get "C-quota" consecutively for two years, they will be fired. Firing will reduce the staff level, which creates more backlog and stress. As backlog increases, the morale of employees will diminish due to overwhelming workload. This idea is captured in the loops shown in Figure 3-7.

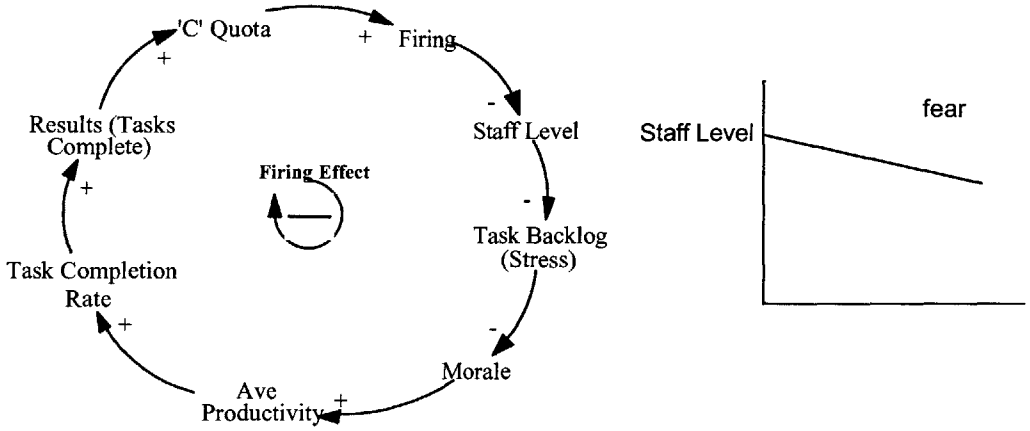


Figure 3-7 Firing Effect on Staff Level

Experience Drain

Experienced employees are valuable assets to organizations and it may take sometime to replace those skills. The new reward system is not giving any special consideration to the experience of employees and that may lead to reduction in technically experienced employees.

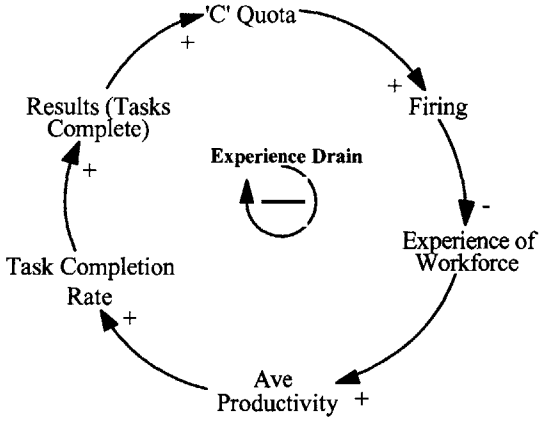


Figure 3-8 Experience Drain

Firing reduces the experience level of the workforce. One alternative to offset the fired skilled employees is to hire experienced employees. But unfortunately it may not be practical to hire many experienced employees in a short period of time. It is captured in Figure 3-8.

Burnout

Because of the implementation of C-quota, the lowest ranked employees are fired, which decreases the staff level. Due to the reduction of staff level, now there are only few people to work on the project. When there are fewer employees to work on the project, the task backlog will increase. One way reduce the backlog is to have employees work overtime. However, if the workweek stays too high too long, fatigue sets in and productivity and results suffer. This is illustrated in Figure 3-9.

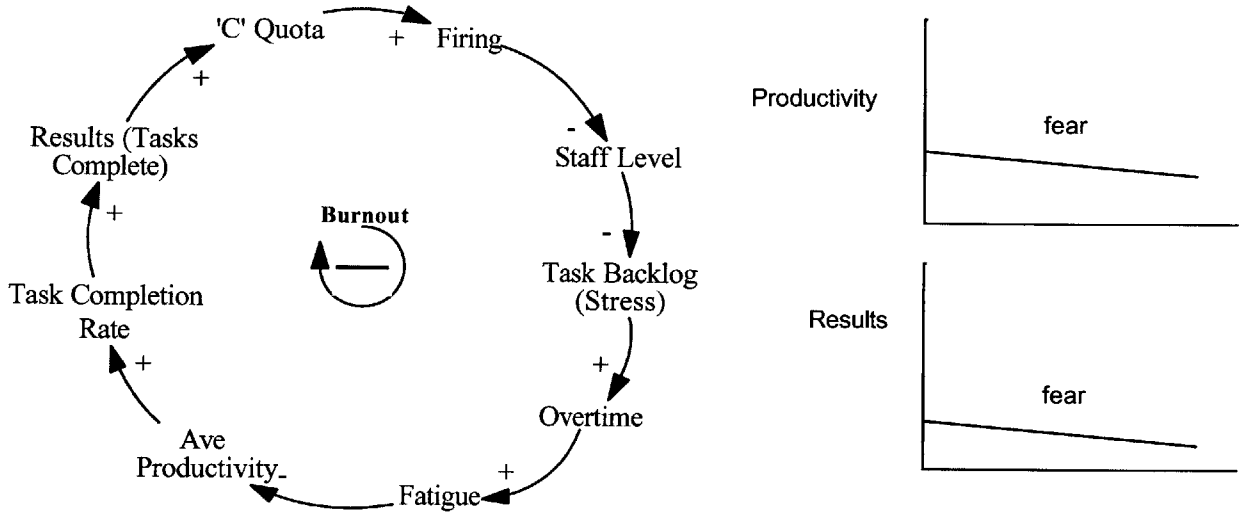


Figure 3-9 Burnout

Overall Picture

Combining all loops developed in addressing the dynamic hypotheses produces a single causal loop diagram as illustrated in Figure 3-10. It shows a complete interaction of all the chosen variables. The potential fear and hope behaviors described in the reference modes may be produced as a result of the combined loops represented. The question is, how can we empower the loops that can produce the hoped-for behavior, and ensure that the detrimental potential

behavior does not materialize? In order to assess the validity of these dynamic hypotheses, a system dynamics model was formulated with the combined causal loops serving as the basis for the model structure.

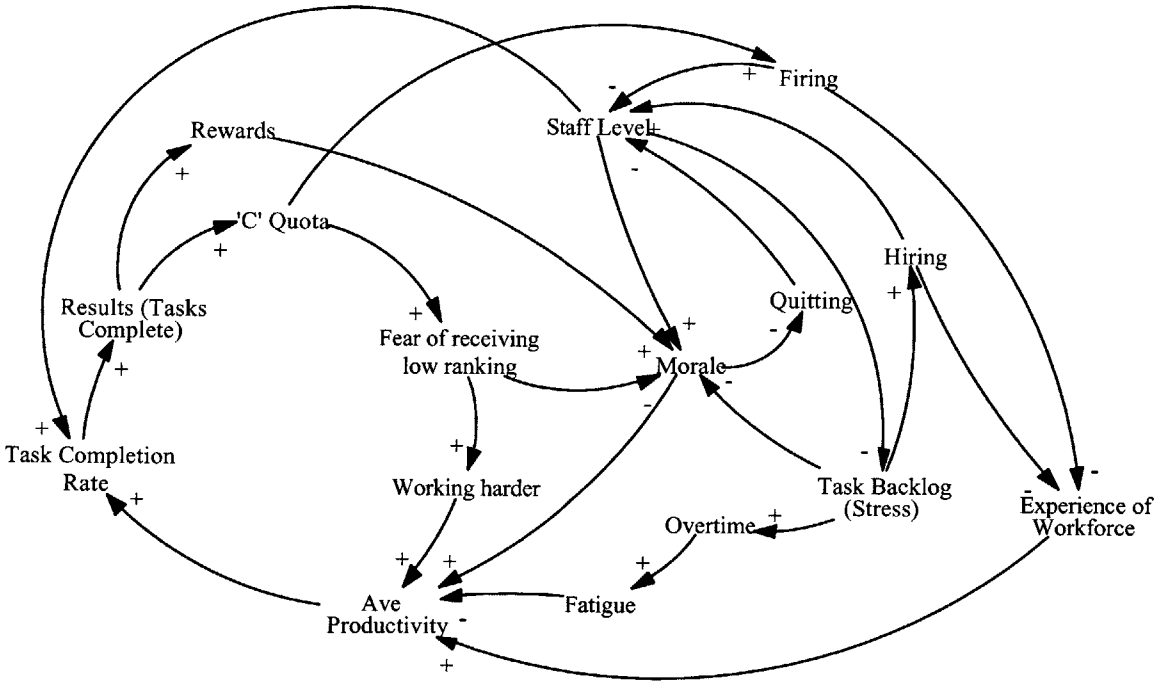


Figure 3-10 Combined causal Loop

This formulation will help us study the effects of two different policies: 1) Maintain (or increase) the quota based on good results (i.e., this quota thing seems to be working, so lets keep it going); and 2) Decrease the quota based on good results (i.e., we've weeded out the bad guys, so now we don't have to have such a high quota of "C" players). The importance of studying these two policies is our second insight discussed below.

Hypotheses-1

If management chooses to maintain the existing 10% C-quota over time, then morale will decline exponentially, and results may initially rise due to fear but may decline exponentially as shown in Figure 3-11.

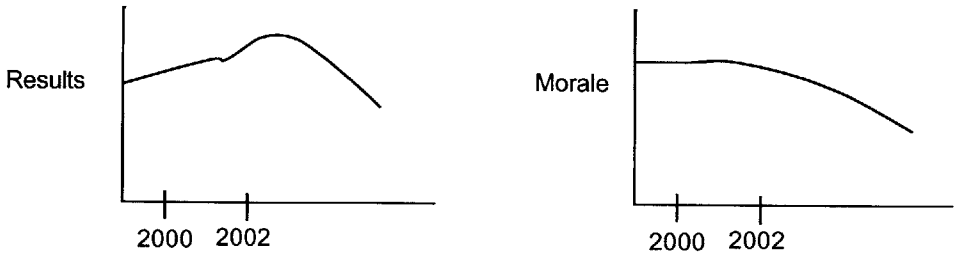


Figure 3-11 Perception of Results and Morale under hypotheses -1

We believe dynamics will occur this way because the C-quota will cause morale to go down which causes productivity and results to decline, which, in turn, causes management to maintain the quota (under the assumed policy). Simultaneously, firing and quitting occurs, which reduces staff level and increases stress, fatigue, and inexperience—further hurting productivity and results. Hiring could help, but we don't anticipate this in the near term. Results may initially rise, due to a motivating effect of the quota that exists, until people are actually labeled "C" for the first time.

Hypotheses-2

If management chooses to significantly minimize the quota as a response to good results, then morale and results will stabilize.

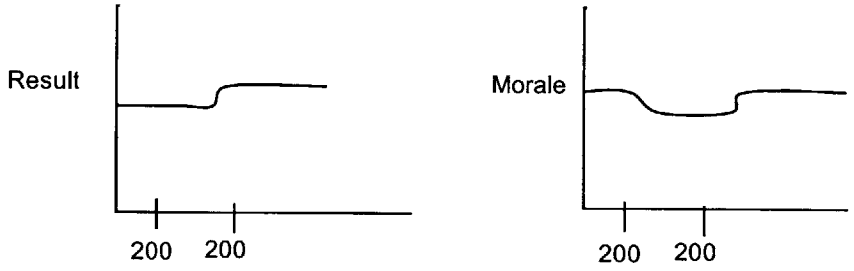


Figure 3-12 Perception Result and Morale under hypotheses -2

In this case, non-productive workers will be weeded out of the workforce. This weeding seems potentially important and it is captured in the weeding out of low performers loop diagram. Morale may take an initial hit, but when the quota is stopped, and results actually improve due to a more productive workforce, morale will recover. Morale and results are likely to stay stable, unless the effect of better and better results is linked to morale.

Chapter Four presents the architecture and development of a system dynamics model, which will produce insight that leads to recommendations to improve the employee, evaluation "rank and fire" policy.

Chapter 4: Building the Model

In order to test our dynamic hypotheses, we focus on building a model that reflects the hypotheses. Modeling, as part of the learning process, is iterative and a continuous process of formulating the hypotheses, testing, and updating to represent the formal and mental model. The model is based on the interviews done with the staff of Company A. It is not intended to be comprehensive. It helps explore basic dynamic relationships between key variables and it does not predict exact values. We will follow a step-by-step process and build a couple of major loops that represent the hypotheses presented in Chapter 3 and try to understand them well. As we become comfortable with our analysis, we can add more loops to derive more insights. We then analyze the model's structure and behavior with the objective of drawing useful insights.

As shown in Figures 3-1 and 3-2, the reinforcing loops help the company's hopes of increasing its bottom line. Some of the key variables like C-quota, rewards and hiring can affect the magnitude of declines in morale, staff level, productivity, and results in a big way. It is interesting to note that management has direct control over those variables like C-quota, rewards and hiring. They can decide when to increase the C-quota or increase the number of people to be hired or how much reward is to be given.

Stocks and Flows

In system dynamics, the term "stock" (also referred to as a "level") corresponds to an accumulated entity that can be measured at any moment. A stock is an accumulation of something, and a flow is the movement, or flow, of the "something" from one stock to another. Mathematically speaking, a stock is an integral and flow is the rate. Some examples of stock are: water in a bathtub; engineers in a company; colleges in a state; etc.

As a first step, we will be using four stocks in this model: Morale, Staff Level, Fear and C-quota. Morale is measured by employee satisfaction. In our model, we made it in such a way that it ranges from zero to 100% in value and the stock is represented in Figure 4-1. There is an annual

survey of employees to provide the data on employee satisfaction. This stock represents customer satisfaction and, under favorable conditions, when customers are satisfied, morale increases, and when customers are not satisfied, morale decreases. Morale gets updated based on employee's fear due to the new policy, the rewards, and due to the impact of C-firing.

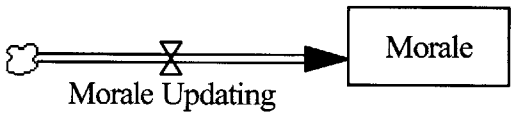


Figure 4-1 Stock and Flow for Morale

The staff level stock shown in Figure 4-2 is affected by several factors, such as C-firing (the rate of firing due to C rating), Quitting (people whose morale is down and fed up with company and leave), and Hiring.

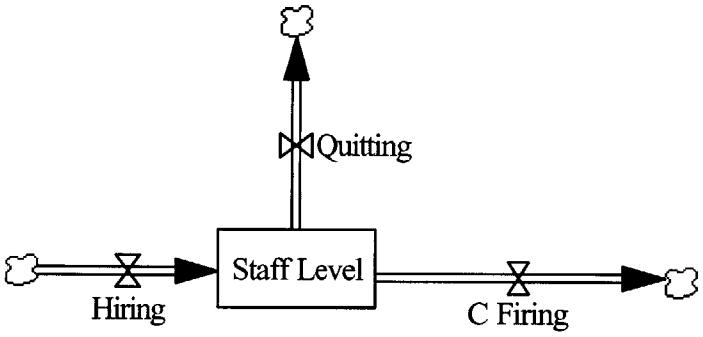


Figure 4-2 Stock and Flow for Staff Level

The staff level will be increased at the rate of hiring and will be reduced due to quitting and firing. We want to explore different strategies for hiring to replace just the quitters or replace those who are fired due to C-ranking.

We have illustrated employees' Fear as a stock in Figure 4-3. Fear is also treated in a manner similar to morale where the value increases as quota increases. We assumed the state before the introduction of quota as zero fear, and the fear increases when the quota increases. We do want an employee to work with, say, 100% fear. Like morale, we have an additional variable to give to accommodate the time it takes for the fear to build up.

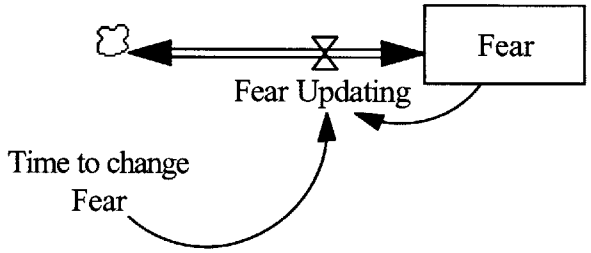


Figure 4-3 Stock and Flow for Fear

Another stock that we have defined in our model was to represent the C-quota. From the causal diagrams, it was clear that C-quota has an important role in managing loop interactions. This is shown in Figure 4-4.

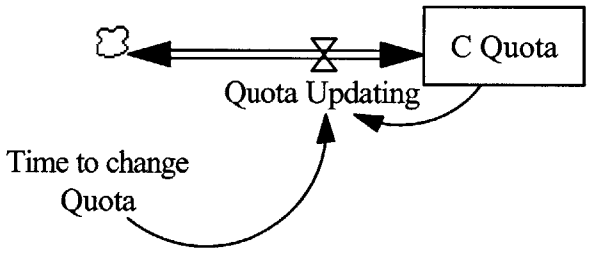


Figure 4-4 Stock and Flow for C-quota

Some of the other key auxiliary variables considered are results and rewards. In the initial model, the result is treated as a dimensionless variable to keep it simple. Maybe it can be modeled as a stock at a later time to represent more realistic situation, when more field data is available. The nature of the problem is very sensitive, and it is very difficult to get actual real-world data. Reward is also treated as a dimensionless variable. It is the conceptual link from Results to

Morale. Depending upon the results of the company, employees are rewarded in the form of bonuses, salary and other mechanisms. These results are a key input to morale. During our interview with employees, it was very clear that many them were motivated when the rewards were very high.

Multiplicative Effect Functions

We have defined a few functions that help us to determine the magnitude of the effects of some of the key variables like morale and rewards on productivity. Also needed were some of the effects of C-quota on fear and the effects of fear on morale and productivity. Effects, represented by equations in this model, are based on our experience and feedback from Company A's staff. They represent a directional trend but are not correlated to actual data. But we feel confident that the trend generated is very realistic. These models can be easily updated/revised for future analysis. We believe the functions are generally correct and can be adjusted when data is available.

Morale Effect on Quitting Function

Shown below is an example of one of the effect functions.

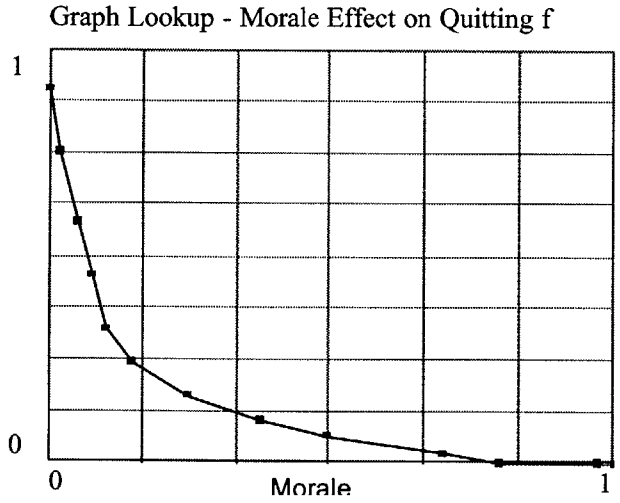


Figure 4- 5 Morale Effect on Quitting Function

This function tells us that a large percentage of the staff will quit the company when morale is low. It resembles a kind of exponential decay. This is illustrated in Figure 4-5. We tried to calibrate the function such that the morale has to become very low to get massive quitting. Of course, it depends on many factors such as the condition of the economy and other variables.

We made an assumption that an 80% morale level represents the current state of the company before the new policy was adopted, and that is our baseline. There is not likely to any quitting when morale is above 80%.

Morale Effect on Productivity Function

This effect function is illustrated in Figure 4-6. The y-axis represents productivity. Morale will have a greater effect at the extremes and productivity will be little less sensitive around the current baseline of 80% morale. Also, even at 100% moral, the productivity effect must have a limit and we estimate it at a realistic number of 1.1.

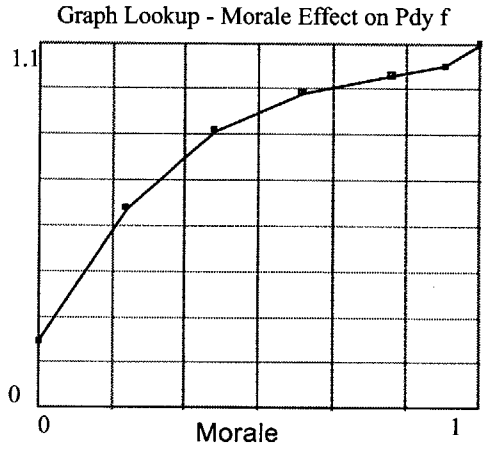


Figure 4-6 Morale Effect on Productivity Function

A 0% morale doe not mean that nothing gets done. Something always gets done at the expense of completely dissatisfied employees. For this model, we assumed that productivity ranges between 0.2 times to 1.1 times today's level. We are assuming only 10% efficiency with increased morale, and that is very reasonable to achieve under favorable conditions. Productivity decreases with a decrease in morale. The rate of productivity decrease is faster when morale is low. The

multiplicative factor is a constant of 1 at 80% of morale to represent today's level. The factor improves by a factor greater than one when morale exceeds 80%.

Reward Effect on Morale

The reward effect on morale is twofold. We believe that the effect can be positive: If the rewards are greater than today's level, then morale will increase. It can also have a negative effect: If the rewards are lower than today's level, then morale will decrease. This is shown in Figure 4-7. Morale decreases by a factor of less than one when rewards are between 0 and 1 times the current level. Morale increases by a factor between 1 and 1/Morale when rewards exceed current levels. This formulation of 1/Morale will keep the upper boundary limit of morale to be less than 1, or 100%.

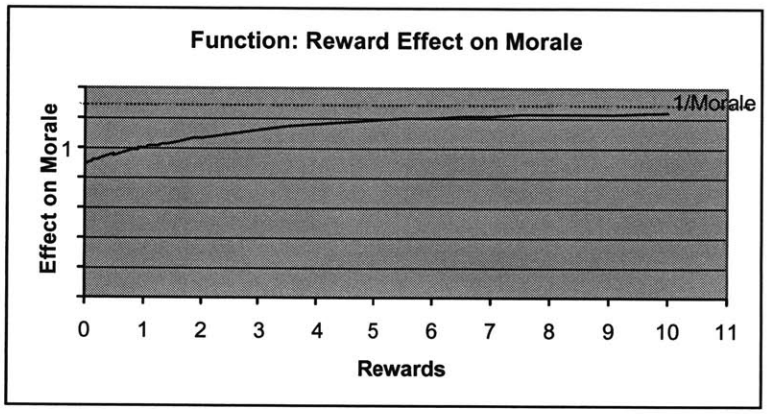


Figure 4-7 Reward Effect on Morale

C-firing Effect on Productivity

We believe that the firing of poor performers will improve Average Productivity. Employees feel that they are working in a company with hardworking people and everyone is working very hard to meet the goals. We assume a linear effect function of C-firing effect on productivity. This is illustrated in Figure 4-8. This simple relationship assumes a 1% improvement in productivity for each 1% of staff fired for being C-performers.

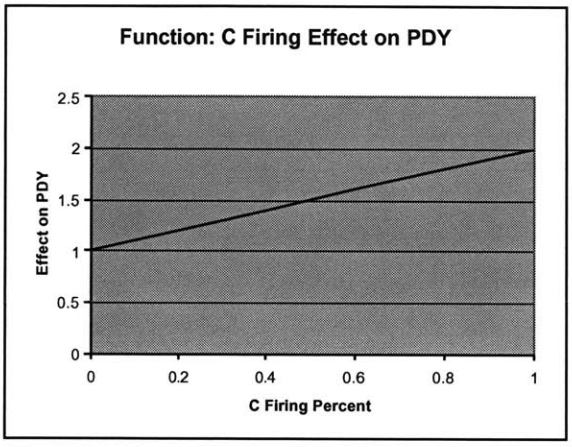


Figure 4-8 C-firing Effect on Productivity

Quota Effect on Fear

As stated earlier, fear plays an important role. The effect of quota on fear is illustrated in Figure 4-9. For lower quota, fear is lower, and when quota reaches 100%, fear also reaches its maximum. The relationship is not linear, but rather increases exponentially.

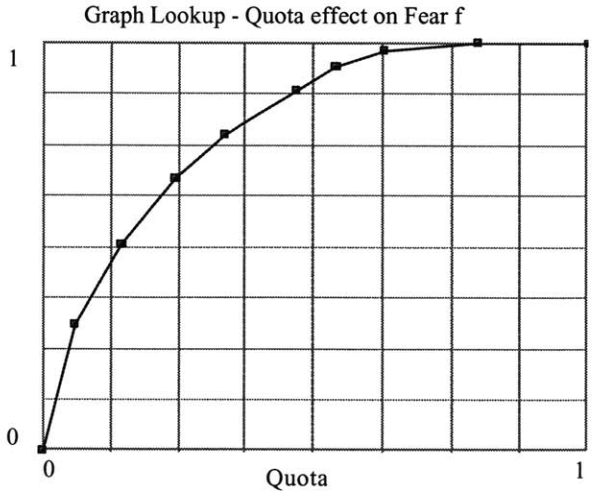


Figure 4-9 Quota Effect on Fear Function

Fear Effect on Productivity

Employees work harder when they fear getting a low ranking and low rewards. But there might be a point when the fear exceeds a certain level, the employee may give up and may not be able to be productive. The fear effect on productivity is illustrated in Figure 4-10.

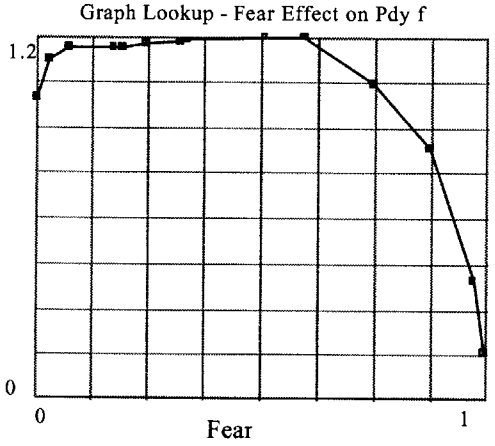


Figure 4-10 Fear Effect on Productivity Function

Fear Effect on Morale

Certainly, fear has an effect on employee morale. Employees want to avoid working in a fearful environment.

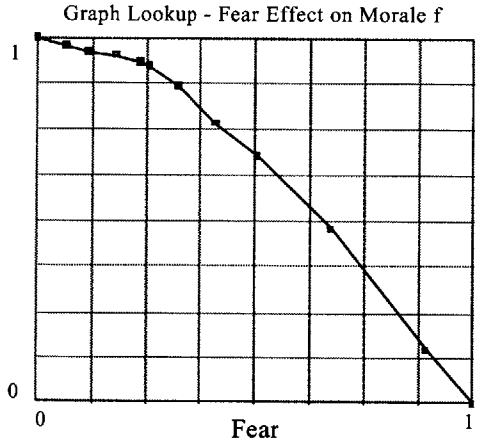


Figure 4-11 Fear Effect on Morale Function

Under such circumstances, their productivity will be much less compared to an environment where people are not fearful. This effect is illustrated in Figure 4-11.

Putting it all together, we get the model shown in Figure 4-12. The model equations are listed in Appendix B.

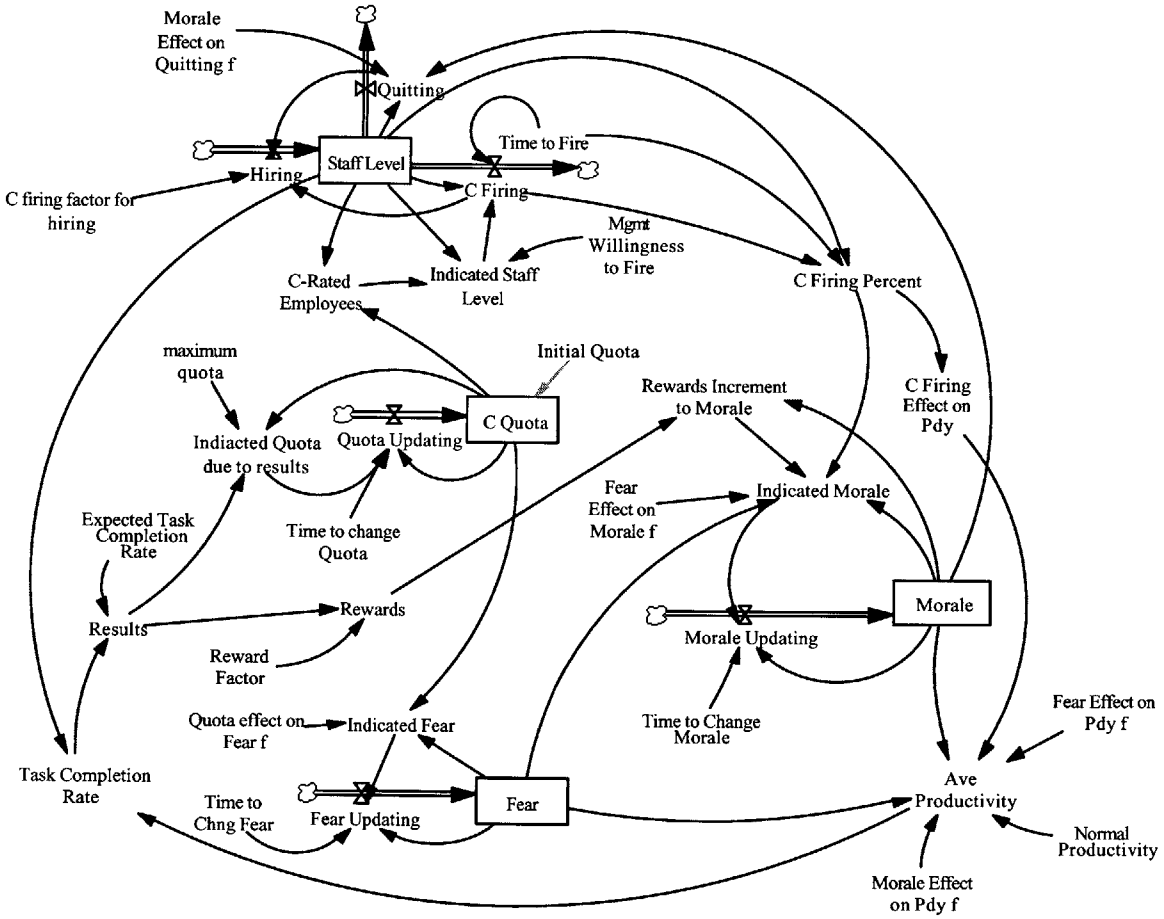


Figure 4-12 Complete Model with Stocks and Flows Diagram

Chapter 5: Simulations and Insights

In order to study the different parameters in the model, we will run multiple simulations, varying one parameter at a time, or a combination of parameters, and comparing the response of morale, results, staff level and productivity. One of the goals of developing different scenarios is to generate a logical policy recommendation for generating favorable results for the Company A.

Baseline and Equilibrium State

We want to begin with the model in equilibrium to be certain that under our current assumption there is no behavior that we wouldn't expect. We are using the state of the company before the introduction of the new policy as the equilibrium condition. Under this situation, there was no C-quota, hiring was the same as firing and quitting. We ran a simulation with the assumption that the C-quota was set to zero and then another simulation with an initial C-quota set to 10% and the maximum C-quota possible was also set to 10%. The reward factor was set to 1 and hiring was done only to replace the quitters. The graphs of some of key variables are given in Figures 5-1, 5-2, 5-3, 5-4 and 5-5. Our initial simulation was with C-quota at 10%, since Company A started the new policy with a 10% ratio. We are calling this our baseline simulation.

As illustrated in the graphs under equilibrium, as expected there was no change in morale, productivity, results, and staff level. So at today's level, the system remains constant.

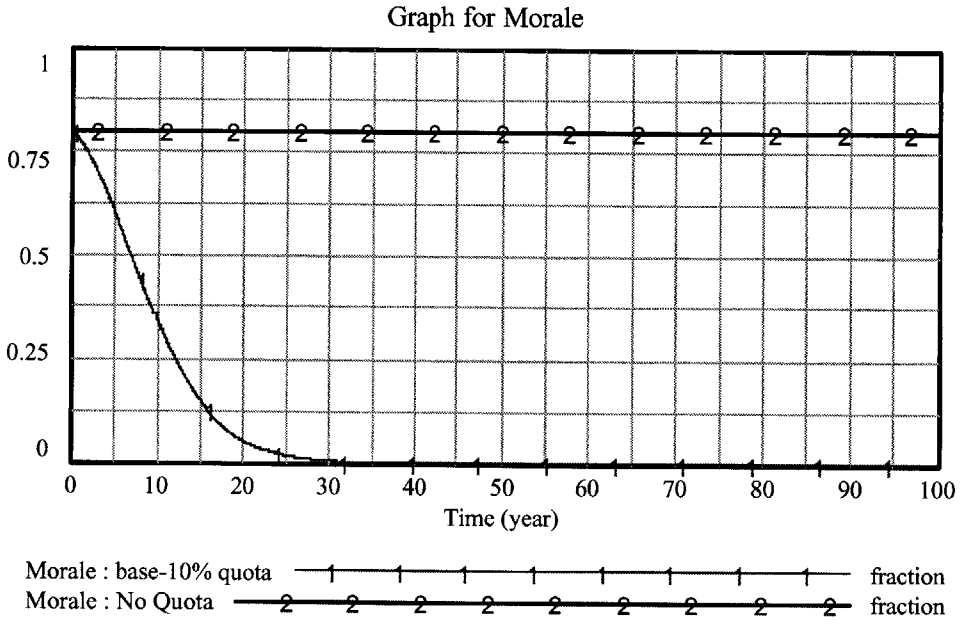


Figure 5-1 Employee Morale under baseline

Under our baseline with C-quota at 10% everything changes rapidly. As shown in Figure 5-1, the morale changes exponentially down to zero.

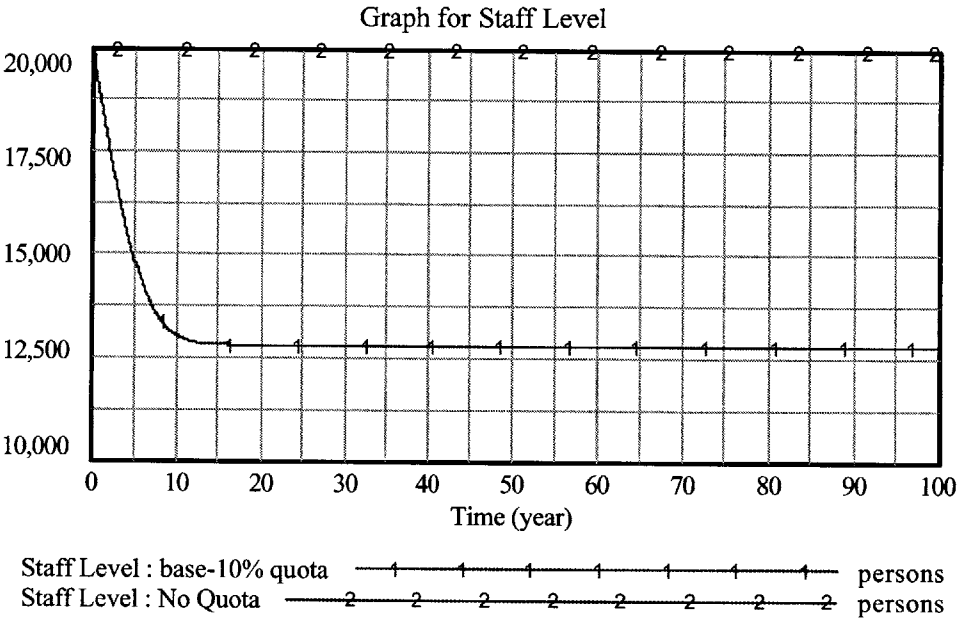


Figure 5-2 Staff Level under baseline

Under the baseline, the staff level declines to 12,500 in about 10 years, as shown in Figure 5-2.

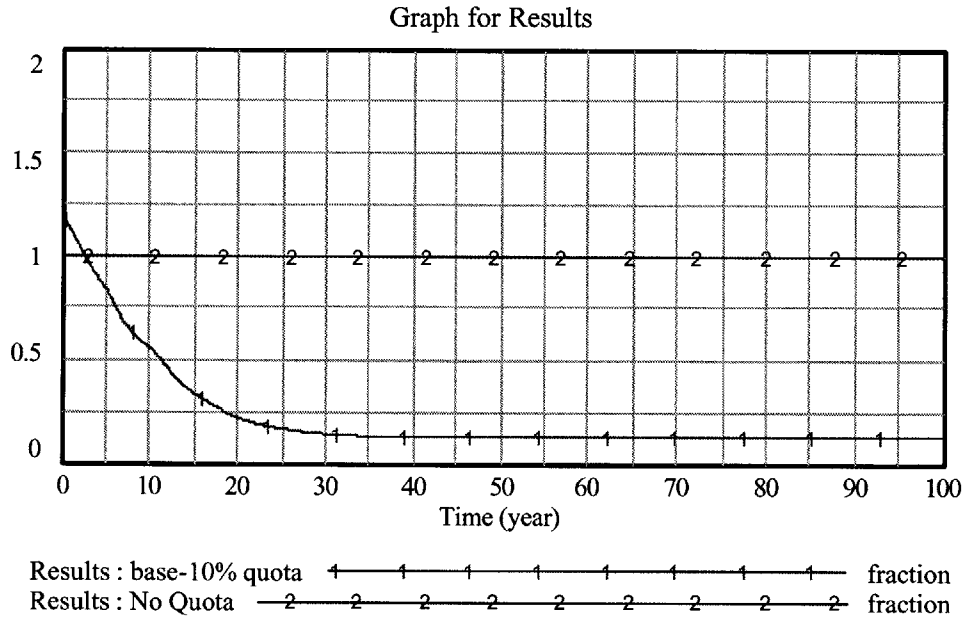


Figure 5-3 Results under baseline

The impact on results is illustrated in Figure 5-3, where there is a positive change in results in the early stages of a baseline quota of 10%. As time goes on, the result decreases in an exponential fashion.

It is interesting to note that productivity as shown in Figure 5-4, increases in the beginning but later decreases as exponential decay may be due to the negative effect of lower morale.

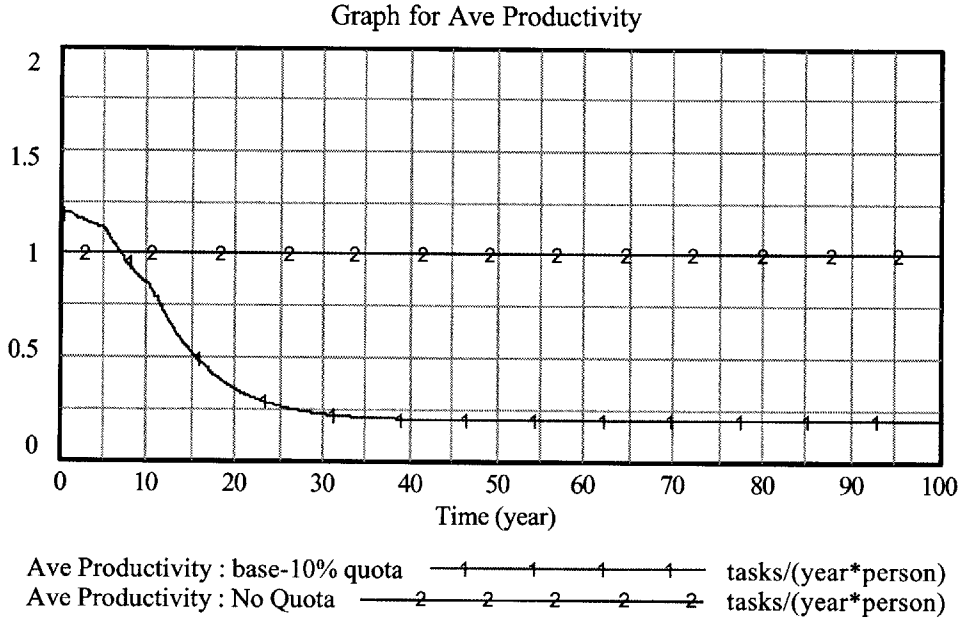


Figure 5-4 Average Productivity under baseline

Our equilibrium is with zero C-quota employees. As explained earlier, under equilibrium, the model shows no effect on any of the variables. Our baseline of a 10% quota assumes no compensatory actions, or there is nothing included that would make up for the negative effect of incorporating C-quota. We want to study the negative effects. We recognize that the base line is unrealistic and we would not recommend such a policy that will affect the future of Company A. We want to show the negative effects of the C-quota without any additional measures.

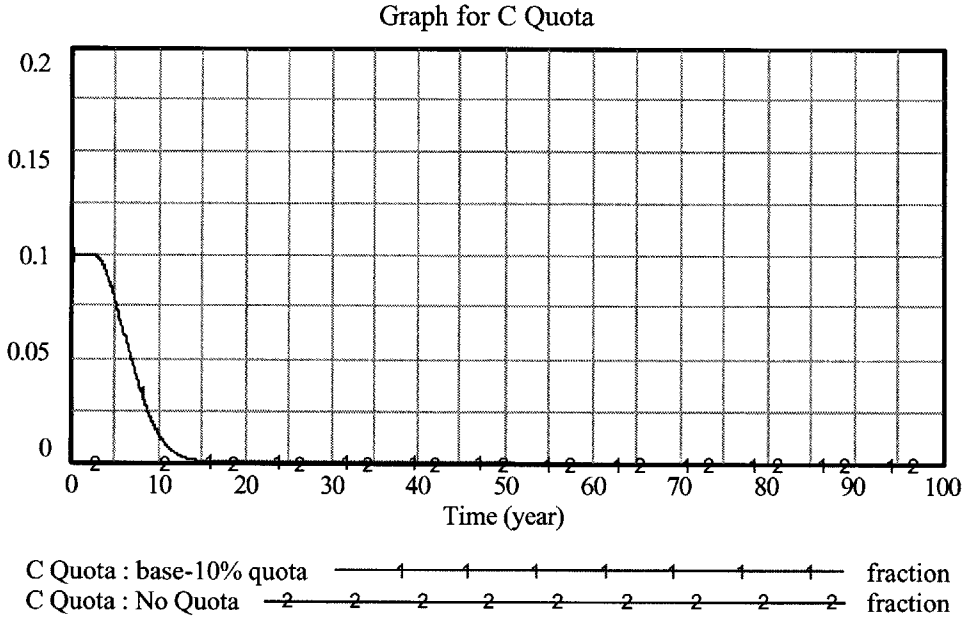


Figure 5-5 C-quota under baseline

We have included a willingness to fire factor to account for the firing that takes place when employees receives C ranking. This is illustrated in Figure 5-6. In Company A's new initiative, the firing takes place only after an employee receives two consecutive C ratings. So, if the management is unwilling to fire, they can manipulate ratings to keep people on board by, say, alternating the C rating among a couple of people every year. To account for that, we didn't include the firing of 10% since we thought that, in reality, much firing won't happen every year. In fact, in our model, we set the willingness factor at 0.3 in our simulations, so firing is essentially 3% per year. As expected, without compensatory actions, the fear of our reference mode is realized in the runs that we showed. As we can see in the above simulation, the baseline analysis shows that the fear factors are affecting the performance of Company A.

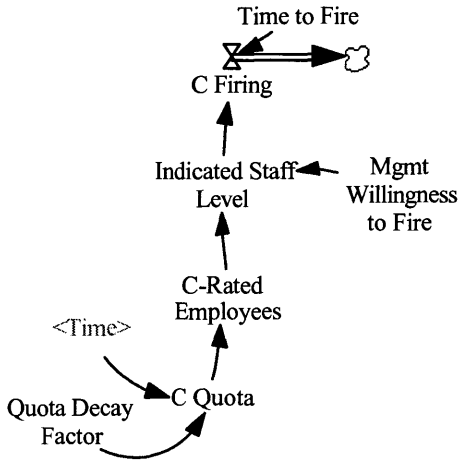


Figure 5-6 Management Willingness to Fire

Reward Influence

In this scenario, we are changing the values of the rewards to different factors to study their influence on the complete process. Figures 5-7 to 5-10 show the simulated effect of reward factors on morale, staff level, results and productivity. Here, we have shown the effect of rewards factors of two times, three times or five times the baseline reward factor of one.

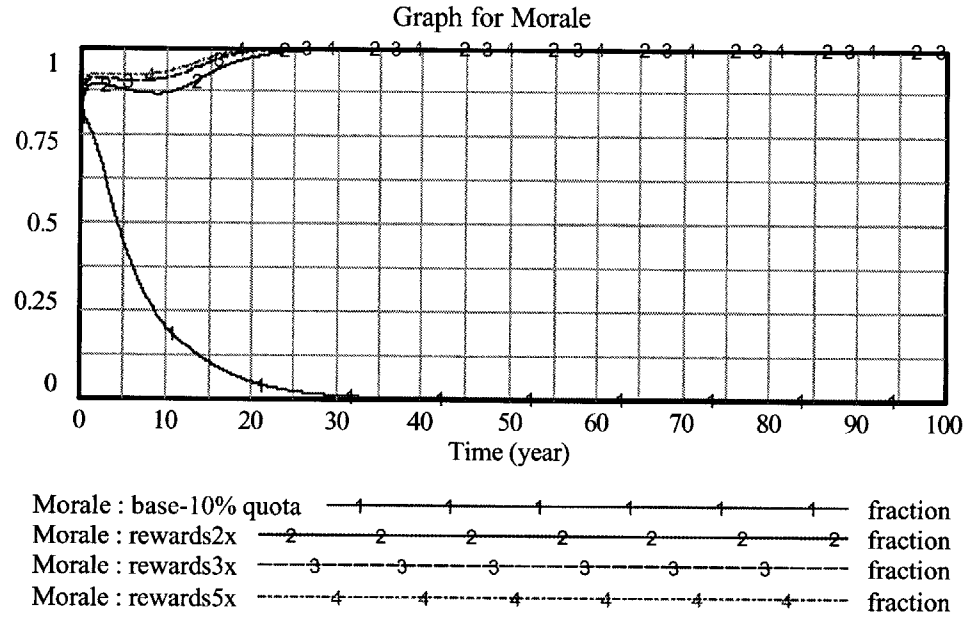


Figure 5-7 Reward Influence on Morale

Rewards given to employees can be changed by management's decision to promote the new policy and will support that action because management believes that the new policy will bring better results to the company's overall performance.

The graph for morale (Figure 5-7) shows that as the reward factor increases, morale increases over the same period of time. So, the increased rewards directly improves morale, but after some time, say in this case, 15 years continued firing and associated quitting eventually leads to decline in morale.

The staff level shown in Figure 5-7 also declines at a slower pace. Company A would like to keep the existing workforce or reduce the workforce over a period of time while keeping up good level of productivity and morale.

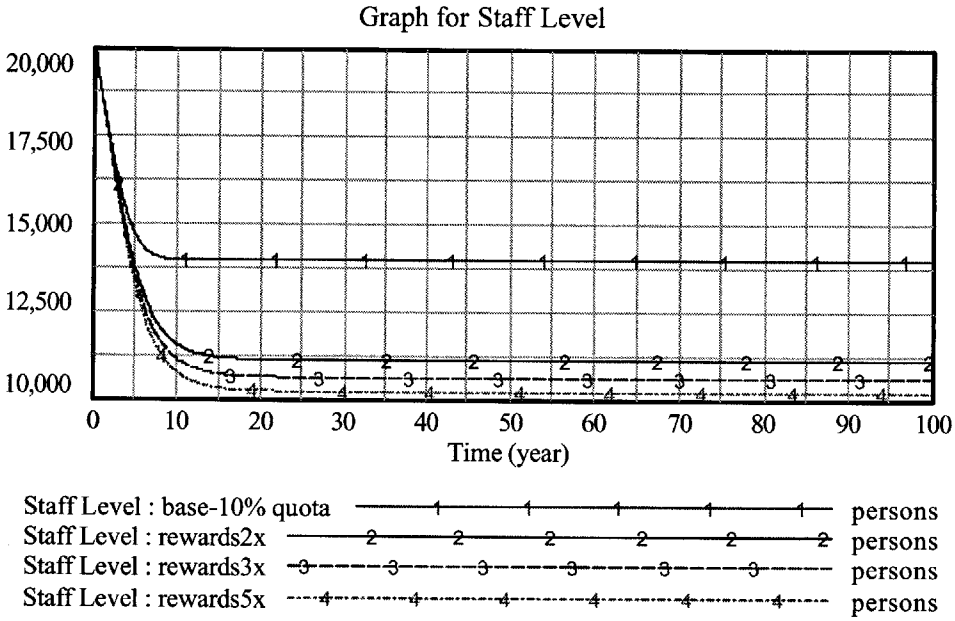


Figure 5-8 Reward Influence on Staff Level

The results shown in Figure 5-9 shows a similar pattern as the baseline case with a solid increase in the initial stage and then decrease in value.

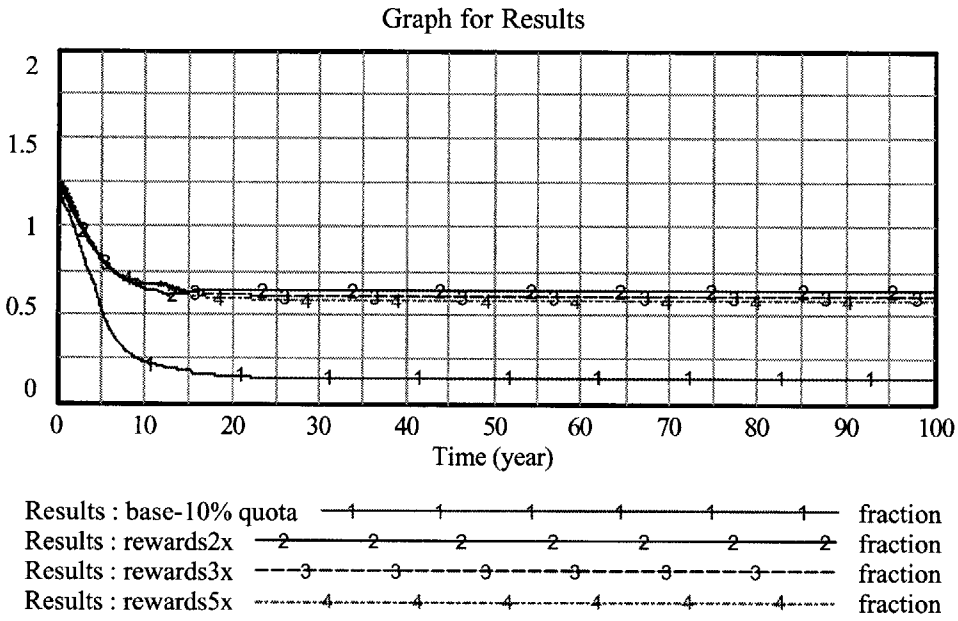


Figure 5-9 Reward influence on Results

Also, the trend is clear that as rewards increases, the result also increases.

Figure 5-10 shows the effect on productivity: Productivity increases substantially with higher reward factors.

This action alone may be good enough to prevent the negative effect of C-quota if one is not concerned about long-term effects, but the costs could be too high. It is an effective way to make morale improve quickly.

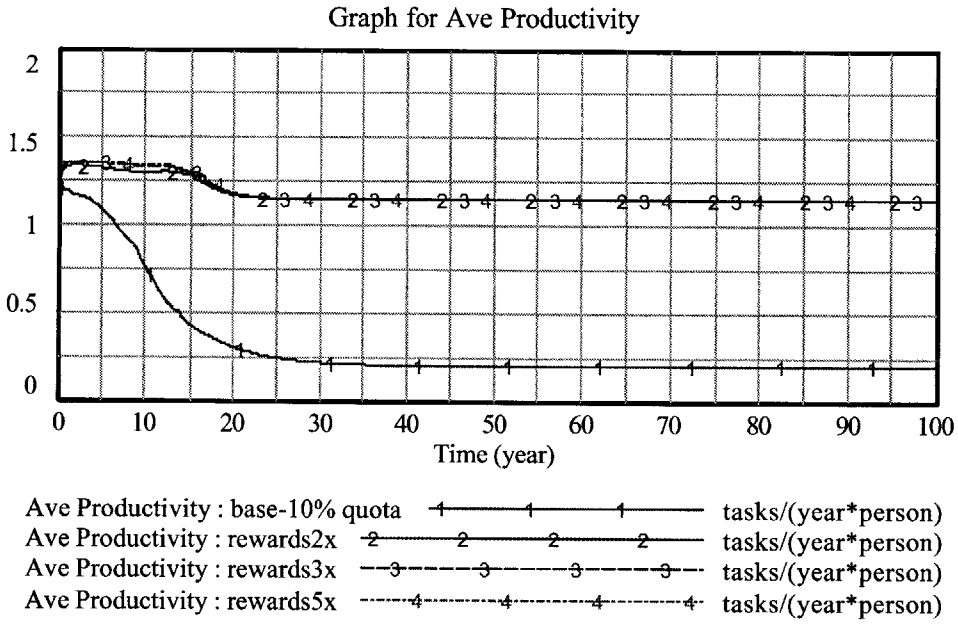


Figure 5-10 Reward Influence on Average Productivity

Quota Management

If we examine the behavior of C-quota in the above simulations, we see a trend that the C-quota stays the same or increases in the beginning and takes an exponential decay direction to no quota stage over a period of time. We wanted to identify the effect of variations in C-quota, so we set simulations with the maximum quota allocation set to 20%, 30% or 40%. The fact that C-quota is reduced to zero over the period of time tells us that in the long run, it may be better for the company to have some sort of quota phase out plan. We want to phase out the quota over a period of time. The simulations of various C-quota limits are illustrated in Figures 5-11. All other variables remained the same as the base line, but we changed the maximum quota to be different. It is interesting to note that the quota increases in the beginning and then it decreases the quota to become zero. The trends shown by other parameters are similar to the baseline case.

We found that initial C-quota values also had an impact. Figure 5-12 shows the effect of C-quota with an initial C-quota of 5% and 15%; as opposed to the baseline case of a 10% initial C-quota. In both cases, the maximum C-quota value was 40%. The simulations show that C-quota

increases in the beginning but does not reach the maximum quota of 40%, and then decreases exponentially to zero quota over the period of time.

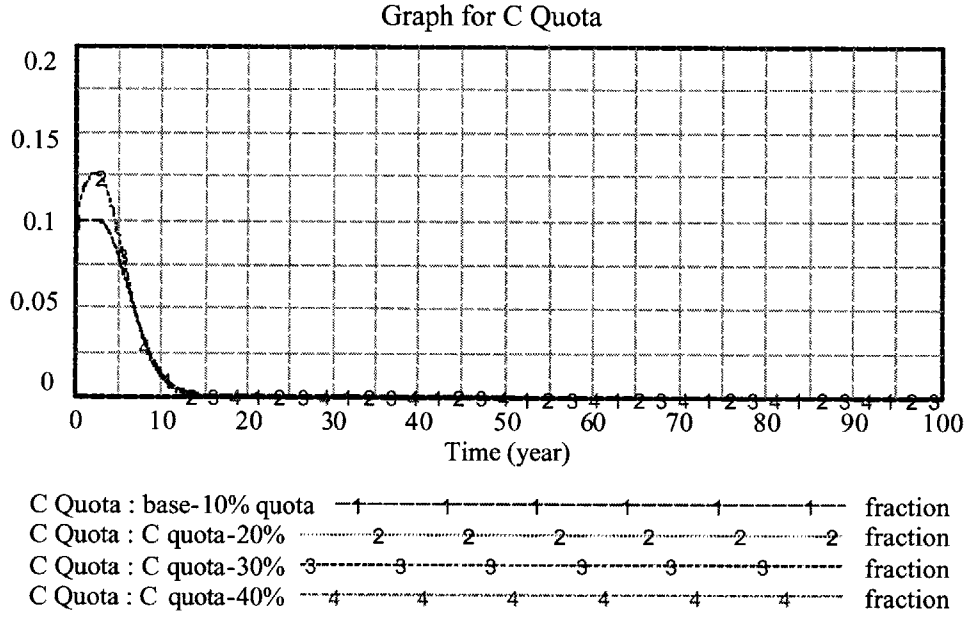


Figure 5-11 Effect of different quota levels

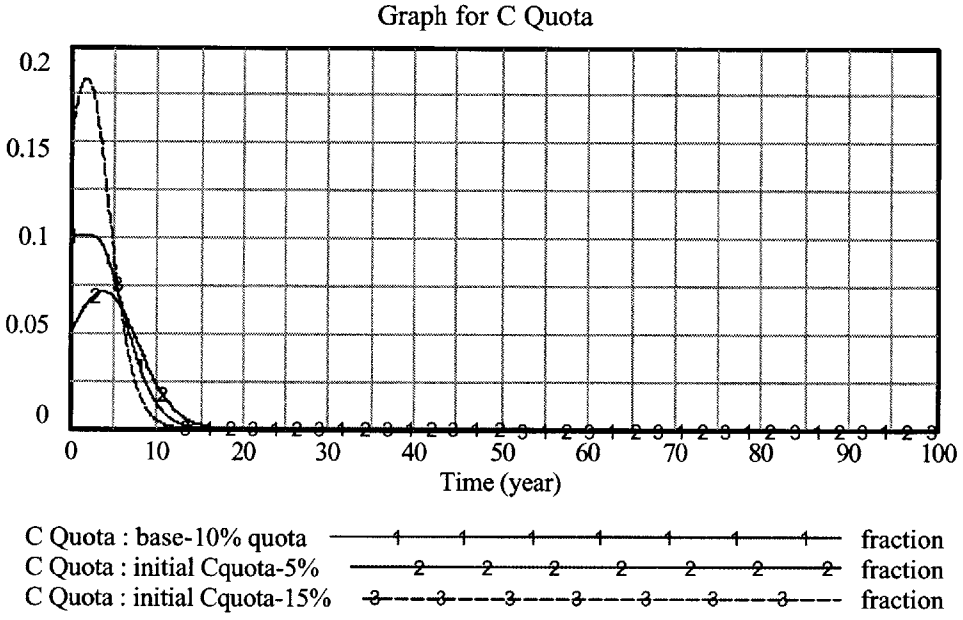


Figure 5-12 Effect of different initial C-quota

These actions alone will not prevent the inexorable slide of morale and other key variables. It may be due to quitting that continues, which affects the overall morale of the company. And while it may be due to a decline in morale, other key variables are also declining over the period of time. But the introduction of decay factors shows better performance than the baseline (without a decay factor).

Managing Staff

Although part of Company A's goal with the introduction of a quota system was staff reduction, some hiring must occur to maintain growth of the company. There are many scenarios by which the company can hire new employees, but it wants to generate best results with fewer employees to improve profits. The hiring option was not covered in the base model. The most basic choices involve whom to replace. It would seem natural to replace those who quit on their own because someone still has to complete their jobs. Replacing fired C players is not always necessary because they were low producers. The two scenarios illustrated in Figures 5-13 to 5-16 are: 1) Hire to replace quitters; and 2) Hire to replace both quitters and those fired.

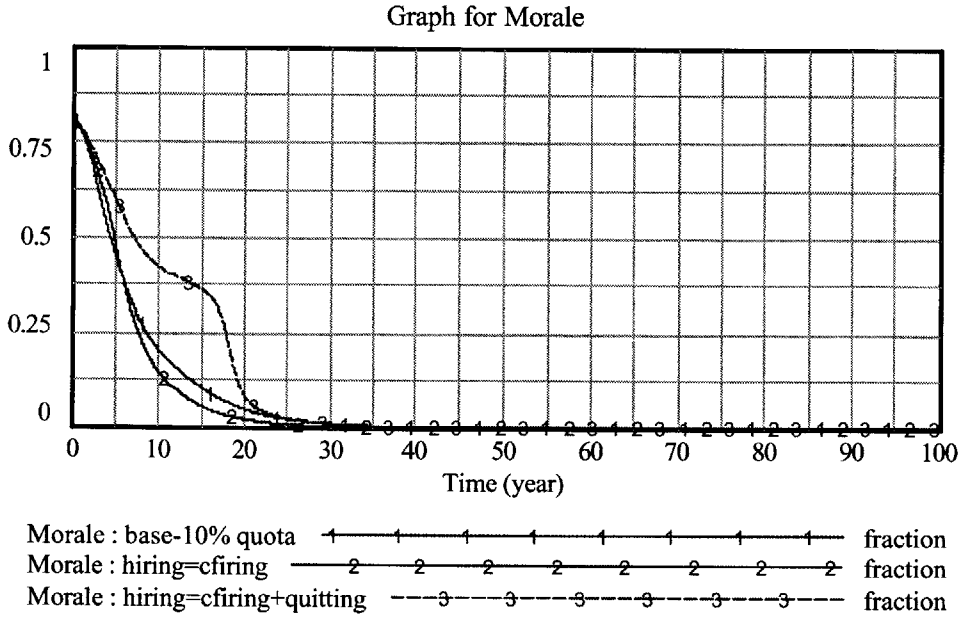


Figure 5-13 Hiring Effect on Morale

These simulations are compared with our baseline simulation of a 10% quota. Hiring maintains a constant staff level, but the firing effect on morale causes all other key variables to decline.

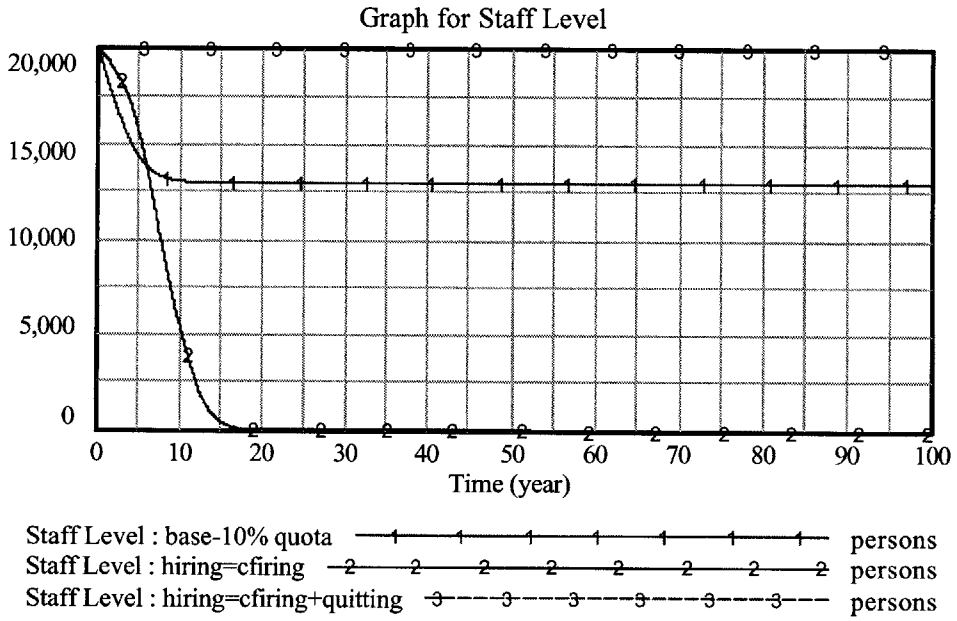


Figure 5-14 Hiring Effect on Staff Level

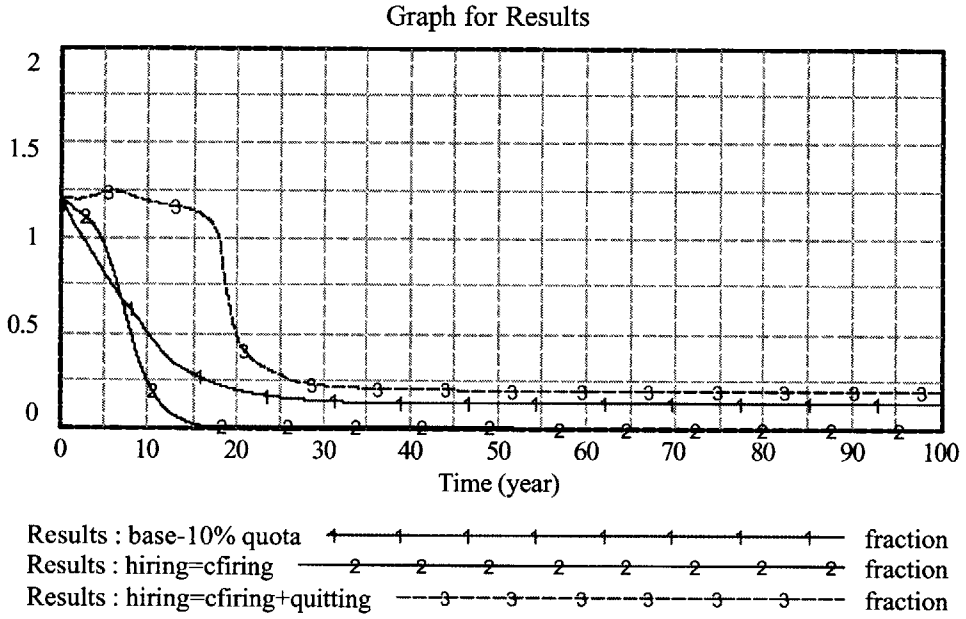


Figure 5-15 Hiring Effect on Results

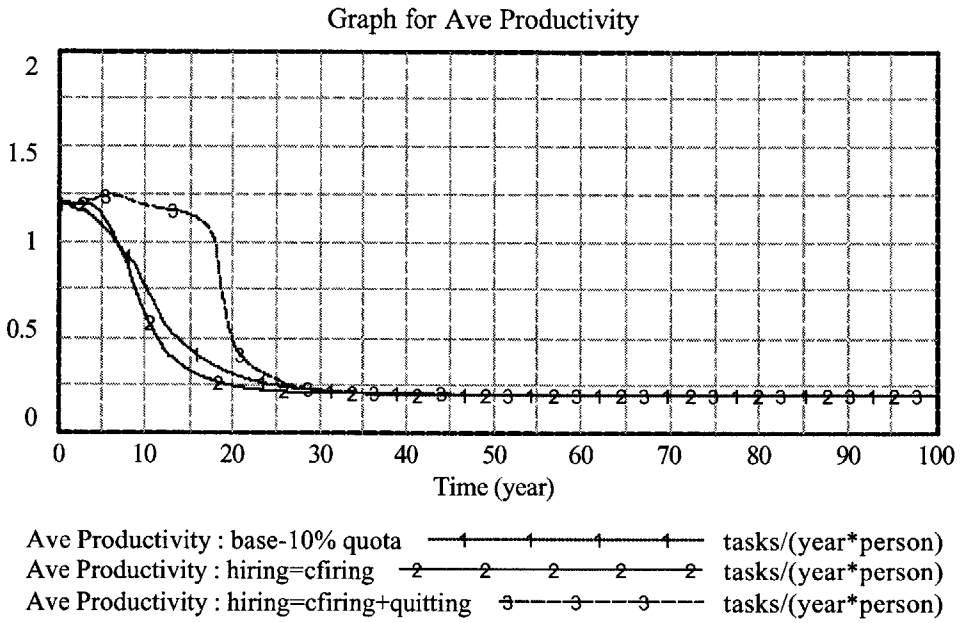


Figure 5-16 Hiring Effect on Average Productivity

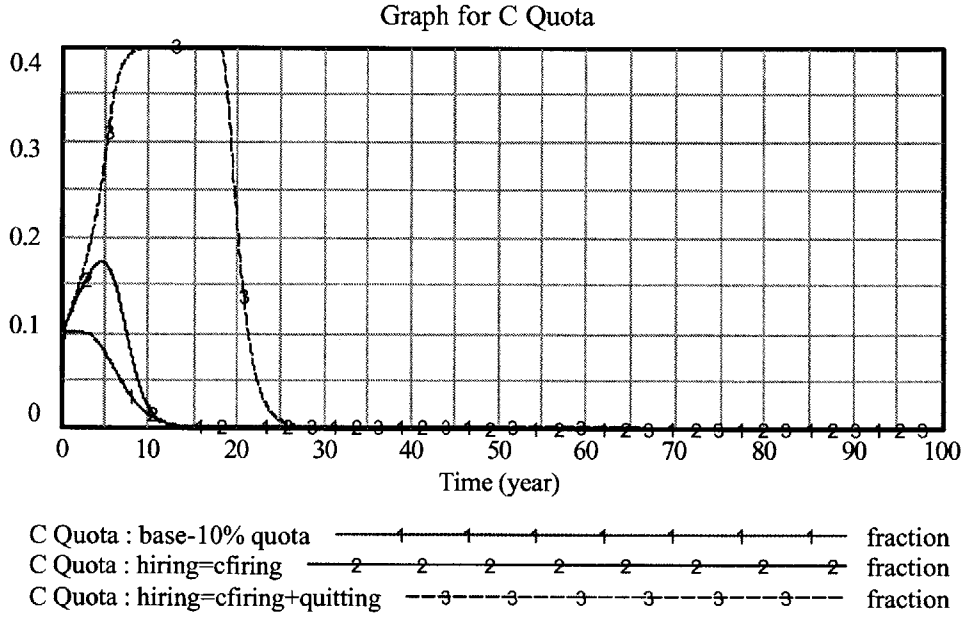


Figure 5-17 Hiring Effect on C-quota

Combination Actions

Apart from the previous scenarios, let us look into combination actions. Here we have explained two scenarios, one in which we replace quitters and phase-out quota, and in the other we replace quitters and phase-out quota and improve rewards, in the order of 1.2x, 1.5x, etc. The simulation outputs are illustrated in Figures-5-18 to 5-22.

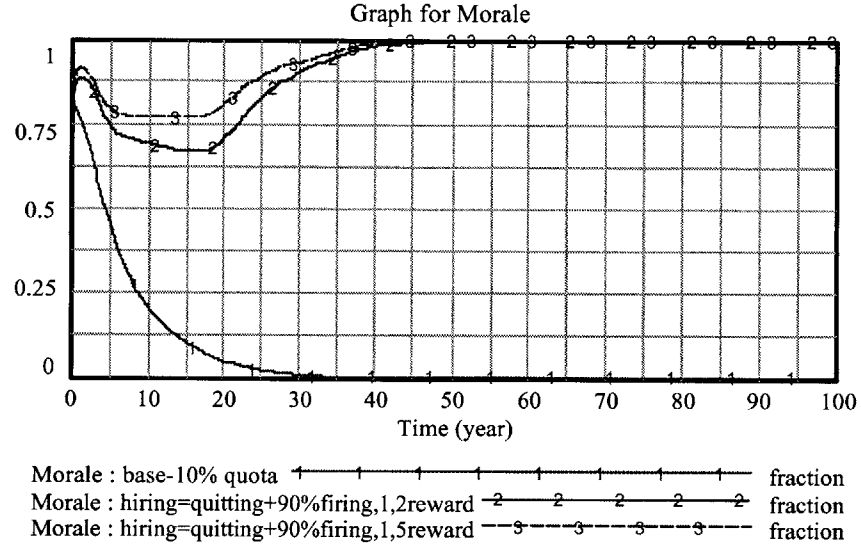


Figure 5-18 Morale under Combinied Action

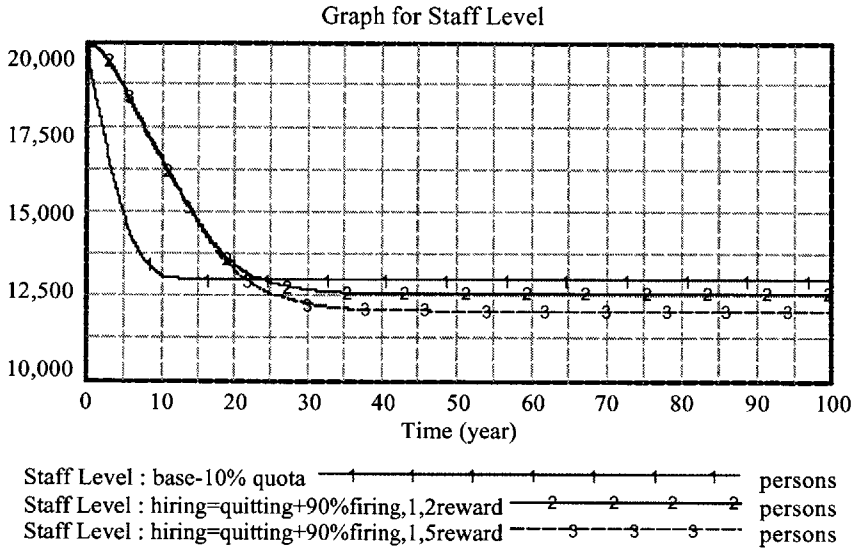


Figure 5-19 Staff Level under Combined Action

The simulations indicate that implementation of one action alone is insufficient to prevent the fears outlined in our reference modes. However, simulations of combined actions reveal that Company A's hopes for the new process can be met.

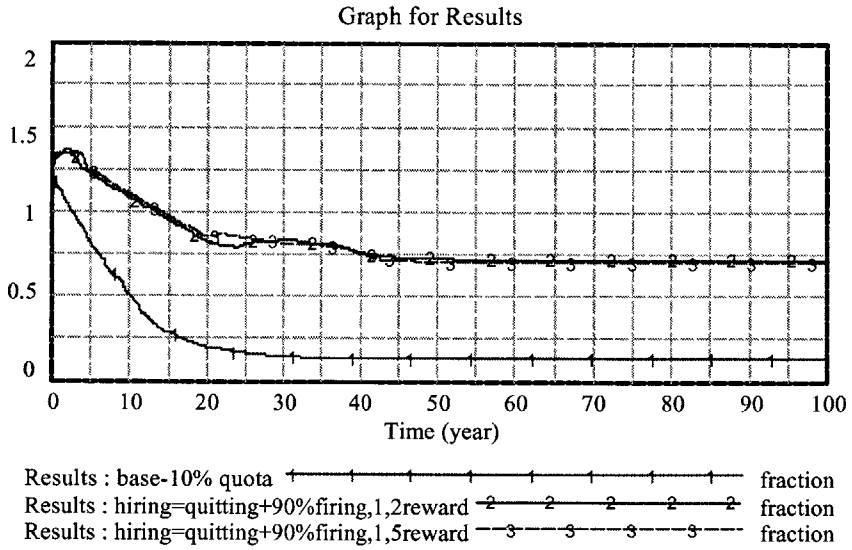


Figure 5-20 Results under Combined Action

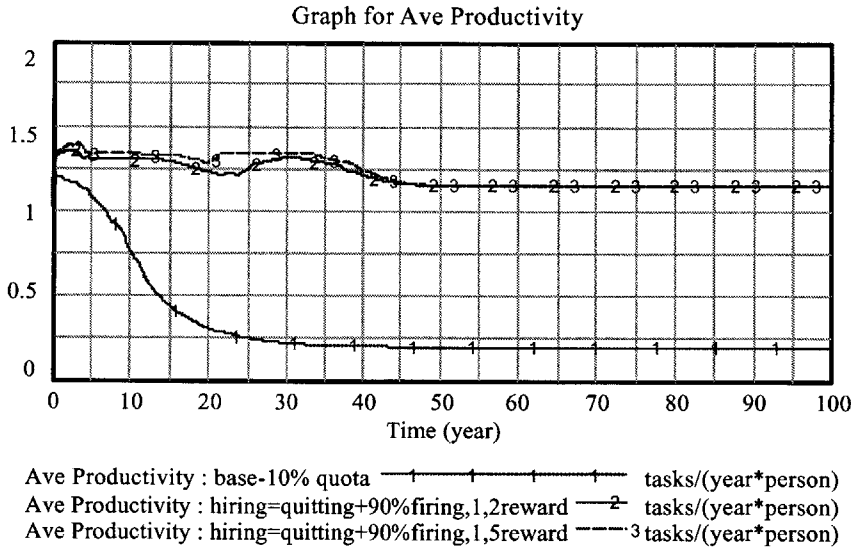
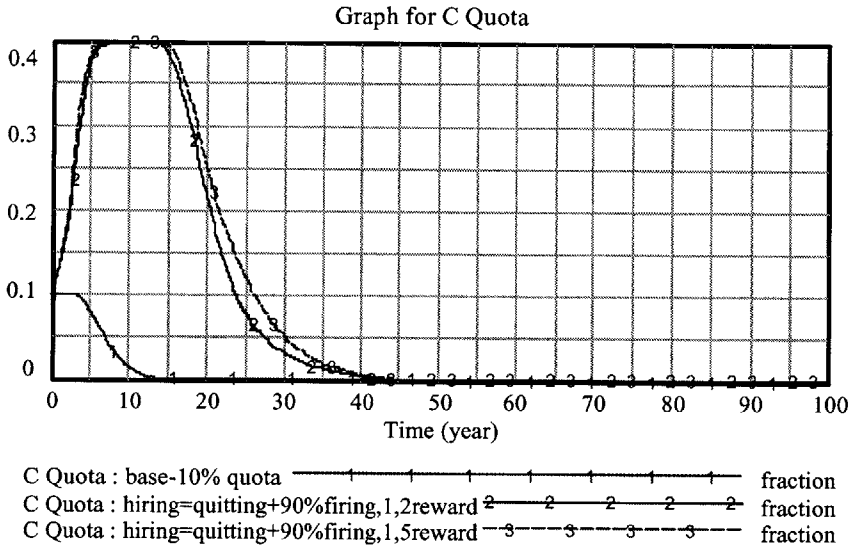


Figure 5-21 Average productivity under Combined Action

The combination actions were quite different from the baseline scenario. The morale of the employees was substantially improved from the baseline. It shows that, as rewards increases, morale also can be improved. But management must decide whether or not to incorporate an expensive choice to improve morale. In our case, we suggested increasing the rewards by five times and two times. Both positions are quite expensive. It is also interesting to note that morale



increases in the beginning may due to better rewards, but later morale declines.

Figure 5-22 C-quota under Combined Action

The most important idea learned from this analysis is to use the simulation as a thought-starter, but not as a prescription. We have looked into major key factors and potential effects have been identified.

Chapter 6: Lessons Learned

The formulation of the equations in the model was quite difficult. Part of this may be due to lack of System Dynamics experience. Some of this may be due to separating fundamental from incidental relationships. Identifying the key variables and narrowing them down to the key variables such as staff level, fear, C-quota, productivity, results and morale took some time to figure out. We found that study of molecules [Hines 1997] was very useful and helped us to build the model and model equations.

Of course, we don't have enough data in correlating the model to predict the exact performance of our key variables. But this is not critical for gaining insight into the problem: However it takes time to figure out how to set up the effect functions in a way that makes the model work. The introduction of effect functions took considerable thinking and understanding of users' input. Even without exact correlation, we were still able to predict trends.

We chose to model morale as a stock ranging from 0 to 100%. This ended up being difficult to model and was an equally difficult task to formulate flows to keep the stock inside this range. While there may be a better way to model this, wanted to keep morale as a true representation of an index of customer satisfaction.

Another challenge was modeling the C-quota as a stock in the model. Trying to include feedback that updates the C-quota based on management's interpretation of its success was another complicated challenge. In our first model, we treated C-quota as an exogenous input. That made the model simple, and easy to implement (see appendix C). But it was an interesting exercise and gave some insights to our study.

There were many other challenges in understanding the problem in general, since this was a new policy being introduced to the employees of company A. There is always a possibility of

logistics issues, such as communication and training relating to the new policy, both of which may have an impact during the first year of introduction.

We recognize that time will have an effect on productivity and rewards in the real world. Productivity will increase over time due to advances in technology. Reward will lose its impact over time due to inflation and other maters. To make the model simple and practical, we did not try to capture those effects.

There were also issues such as finding an absolute bound on average productivity. In the model, we created average productivity to begin at 1 (A dimensionless quantity) to a maximum of 1.1 (10% efficiency). We could have set it as a larger quantity, but we believed the actual value does not matter much for our analysis to determine the trend.

Policy Recommendation

Our main objective is to recommend policies for enabling the hoped-for features from the reference mode to the employee performance of Company A. Based on insights and simulations, we recommend a combination of at least three policy actions (phase out quota, replacement hiring policy and rewards) to make the new "rank and fire" policy work for Company A.

Phase Out Quota

We recommend that the company needs to have a clear plan to phase out the quota over time. During the initial stage, when the new process was introduced, there was no evidence of a rational phase-out plan. Company need to develop and communicate a plan for how and when the quota might be phased out. We also recommend linking the quota level to other factors, such as maintaining productivity, and maintaining necessary technical expertise. For the smooth operation of the company's daily operations, it wouldn't want to fire certain employees with critical skills, because their absence may delay essential functions that may, in turn, delay the launch of new products. Our study showed that, during the early stages of the introduction of the new policy, productivity increased, but later declined, due to morale degradation. It is here that a

planned phase-out helps to weed out the low performers. Our simulations also showed that this can help the process, but this policy change alone is not enough to attain its goal.

Replacement Hiring Policy

Our model indicates the possibility of reducing the workforce while maintaining good results and morale. This was possible by hiring to replace those who voluntarily quit the company and hiring to replace some of the C players. We will hire to replace 90-95% of fired employees. The company also needs a strong promotional effort to attract and retain good people as replacements.

Rewards

As expected, increasing rewards was a key action. Reward is a strong motivating tool for employees and that was made clear in the simulations. In the model, this is an exogenous input that appears to be especially effective for raising and maintaining morale. But when it is used in combination with the other actions, it proved to be a good tool to achieve the goal of the company. We use rewards as a generic concept and want to emphasis that rewards can take many forms. Company A should explore all such possibilities. The rewards can be in any form like financial incentives, promotional opportunities, work/life flexibility, various other forms of recognition, and educational scholarship/opportunities. All of those things tend to improve morale and productivity.

Recommendation from Observations and Insight Gained Working on the Problem

Here are some of the other thoughts that Company A should consider to achieve its goal of being efficient and a leader in its business class. These are not from the model but based on the experience gained after studying this problem. A quota may work for management, but must be careful in applying it to non-management employees, especially those with specialized expertise. Losing technically specialized people could exacerbate productivity loss.

Fairness is another important item to consider in the successful implementation of the policy and for maintaining morale. Fairness in giving a ranking to each employee is critical in the success of this policy. The pool of employees who are being compared will become an important factor as to who gets the low rankings. Every effort must be taken to accommodate the level of employee experience, the complexity of job function, and the effect of external factors. Also, employees need evidence that the quota is being applied at all levels of the company, from top to bottom.

In the implemented model, we do not address various stress factors that aggregate over time. The fact that employees work overtime to meet objectives will add stress in the process. Factors such as overtime are likely to exacerbate quota problems. Company A's efforts to promote team building, diversity, and work/life flexibility are good countermeasures being implemented—and they may need to be strengthened.

Chapter 7: Conclusions

Company A adopted a new "rank and fire" policy of employee evaluation and reward system to promote and reward its employees. This study of employee evaluation based on forced ranking on strict quota allocation for Company A was approached from a system dynamics approach. We started with the concern that Company A's employees felt that the new process would hurt morale and productivity and ultimately devalue the company. A group of employees of Company A were interviewed about the current employee evaluation method and associated concerns. We set out to better understand the embedded mental models of the employees and obtained several hypotheses around employee concern. A standard system dynamics process of listing variables, creating causal loops, building and simulating models was adopted. The interviews were aimed at obtaining the key variables of concern and generating momentum solutions. Emphasis was placed on the fears and hopes for the future. Causal diagrams captured the mental models, or dynamic hypotheses, of why such behaviors could occur. Dynamics arises from the interaction of multiple loops. A particularly troublesome set of feedbacks was selected for closer study via computer simulation, and the effect on employee morale, staff level, results and productivity was developed. Analysis of the model provided guidance for recommending better polices. Intended effects of the policy versus the actual effects of the policy were examined. Momentum solutions were collected at the beginning of the project. The desirability of these solutions was considered at the end of the project in light of the analysis.

We analyzed the model's parameters further from a managerial perspective. The goal was to recommend policies in order to ensure that the evaluation process will be successful to the long-term growth of the company. The effects of increasing, decreasing or eliminating the quota were also analyzed. Recommendations include a more efficient management of quota allocation; better hiring policy and a better reward system. The morale and firing factors were also studied.

The experience of building this simple model and being able to analyze and understand it provides a solid foundation on which a new structure might be developed that reflects additional hypotheses.

Future Work

This study has focused on very few central dynamic hypotheses and led to policy recommendations. There is still a lot of work to do in this field, in order to have a structured method to perform this kind of analysis. We suggest the following areas for future work:

- There are few opportunites to improve the model. We could include stress, fatigue and their effects in the model. A more detailed implementation of fear and overtime could be included in the model. The current model does not account for the experience level of people being hired or fired. With hiring, firing and quitting going on, the experience level of the people won't remain the same and that has an impact on productivity and results of the company. Another area of interest will be the quota effect of the level of teamwork. The present model has not captured the effect on teamwork. We could incorporate different effects of employees in different categories as they are ranked. Employees placed in a specific category may have a different effect on productivity, results, and morale. We could consider modeling results as a stock, which may be a better way to represent output of the company. We have not accounted for the effects of A- and B-ranked players in the company. According to the new policy, the categorization of employee were into A, B and C categories. The roles played by the A and B categories is very important for the overall morale and productivity of the company.
- Calibrate the model with real data, if available.
- Model the other loops presented in Chapter 2, like the experience drain, burnout and weeding out low performers. Explore the possibility of adding more causal loops and add them to the model. Analyze and model the potential new feedback loops emerging from the currently recommended polices.
- Another factor that is missing from the study is the impact of the "rank and fire" policy on organizational evolution [Hines 1999]. The practice bears some surface similarity to the simulated promotions and demotions that have been done in simulations using OrgEv (Organizatioinal Evolution) software. Some of the key questions and problems to answer in that study would be:

- Is the practice evolutionarily sound in the absence of detrimental impacts on areas such as morale? Is the practice good for evolution at its best intentions?
- If the practice at its best is sound, then how bad do the bad effects need to be before they swamp the beneficial possibilities?
- Can this practice of ranking employees be restructured so as to strengthen the evolutionary benefits?
- Figure out a way to restructure the practice so that the evolution is more likely or faster.

Appendix A - List of Variables

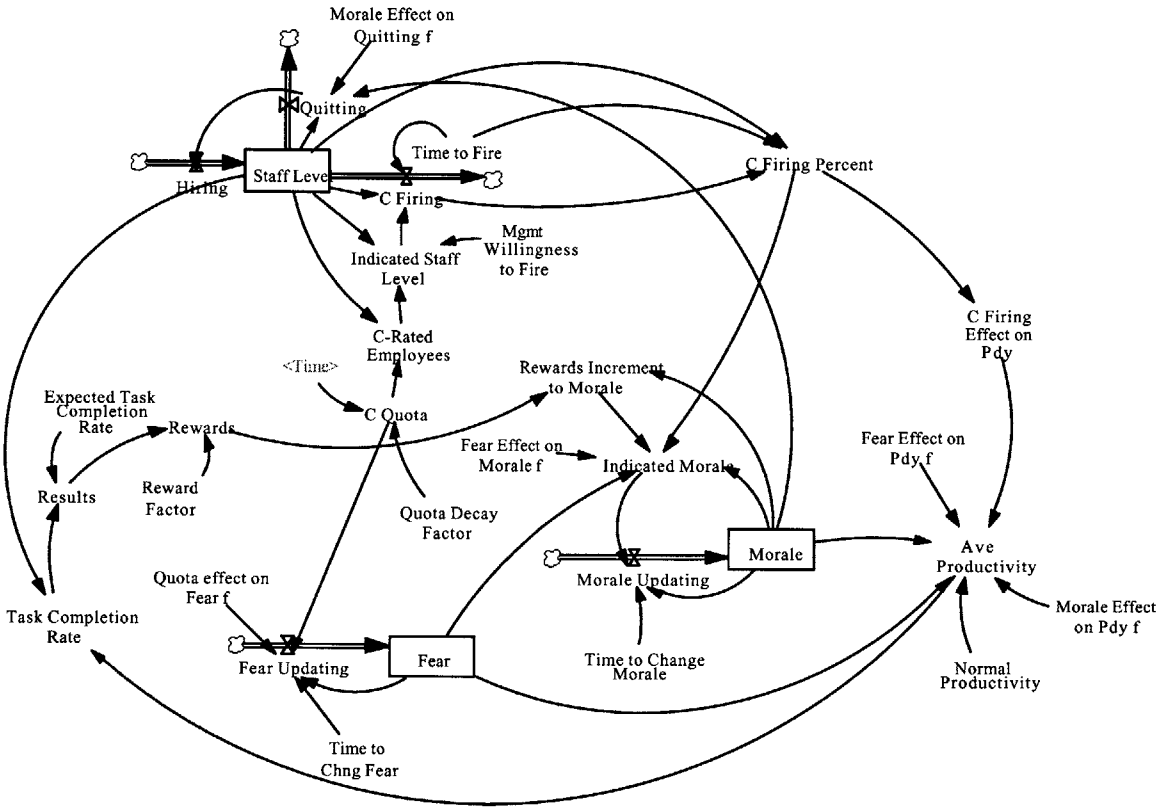
- Number of Employees
- Hiring
- Firing
- Normal Attrition
- Quitting
- Overtime
- Morale
- Quota
- Employee Experience
- Stress (amount of tasks waiting to be done)
- Fatigue (cumulative Overtime)
- Normal Productivity (employee days/task)
- Productivity
- Stress Effect on Productivity
- Fatigue Effect on Productivity
- Tasks
- Task Completion Rate
- Results (e.g., tasks complete)
- Perceived Happiness
- Effect of Perception on Quota
- Fear of receiving low ranking
- Working harder
- Rewards

Appendix B – Equations for Dynamic Model

Ave Productivity=	Normal Productivity*Morale Effect on Pdy f(Morale)*C Firing Effect on Pdy	Units: tasks/person/year
C Firing=	(Staff Level-Indicated Staff Level)/Time to Fire	Units: persons/year
C Firing Effect on Pdy=	1+C Firing Percent	Units: fraction
C Firing Percent=	C Firing*Time to Fire/Staff Level	Units: fraction
C Quota=	0.1*EXP(-Time*Quota Decay Factor)	Units: fraction
"C-Rated Employees"=	C Quota*Staff Level	Units: persons
Expected Task Completion Rate=	240000	Units: tasks/year
	FINAL TIME = 100	Units: year
Hiring=	Quitting	Units: persons/year
Indicated Morale=	Morale*(1-C Firing Percent/2)+Rewards Increment to Morale	Units: fraction
Indicated Staff Level=	Staff Level-"C-Rated Employees"*Mgmt Willingness to Fire	Units: persons
	INITIAL TIME = 0	Units: year
Mgmt Willingness to Fire=	0.3	Units: fraction
Morale=	INTEG (Morale Updating, 0.8)	Units: fraction
	Morale Effect on Pdy f([(0,0)-(1,1.1)],(0,0.2),(0.2,0.6),(0.4,0.83),(0.6,0.95),(0.8,1),(0.92,1.03),(1,1.1))	Units: fraction
Morale Effect on Quitting f(	[(0,0)-(1,1)],(0,0.9),(0.02,0.75),(0.05,0.58),(0.075,0.45),(0.1,0.32),(0.15,0.24),(0.25,0.16),(0.375,0.1),(0.5,0.06),(0.7,0.03),(0.85,0.02),(0.95,0.01),(0.975,0.005),(1,0))	Units: fraction/year
Morale Updating=	(Indicated Morale-Morale)/Time to Change Morale	Units: fraction/year
Normal Productivity=	1	Units: tasks/person/year
Quitting=	Morale Effect on Quitting f(Morale)*Staff Level	Units: persons/year
Quota Decay Factor=	0	Units: **undefined**
Results=	Task Completion Rate/Expected Task Completion Rate	Units: fraction
Reward Factor=	1	Units: **undefined**

Rewards=	Results*Reward Factor	Units: fraction
Rewards Increment to Morale=	IF THEN ELSE(Rewards<=1,(-0.1*(1-Rewards)*Morale) ,((Rewards-1)/Rewards)*(1-Morale))	Units: fraction
SAVEPER =	TIME STEP	Units: year
Staff Level=	INTEG (Hiring-C Firing-Quitting, 20000)	Units: persons
Task Completion Rate=	Ave Productivity*12*Staff Level	Units: tasks/year
	TIME STEP = 0.0625	Units: year
Time to Change Morale=	0.5	Units: years
Time to Fire=	0.5	Units: years

Appendix C - Model representing C-quota as an exogenous input



REFERENCES

[Booth 1995] Booth, Wayne C., Gregory G. Colomb, and Joseph M. Williams. *The Craft of Research Chicago*: University of Chicago Press, 1995.

[Goldberg 1989] Goldberg, David E. *Genetic Algorithms in Search, Optimization & Machine Learning.* Massachusetts: Addison-Wesley, 1989.

[Hines 1997] Hines, James H. *"Molecules of Structure version 1.4"* , Leap Tec, 1997

[Hines 1998] Hines, James H. *"Five Rules for Evolutionary Management."* System Thinker, 1998.

[Hines 1999] Hines, James H. and House, Jody L. *"Policy Evolution within an Organization."* 2000 Design and Manufacturing Conference, Vancouver, B.C,

[Hines 2001] Hines, James H. and House, Jody L. *"The Source of Poor Policy: Controlling Learning Drift and Premature Consensus in Human Organizations,"* System Dynamics Review, Vol. 17, No. 1, Spring 2001.

[House 2000] House, Jody Lee, Alexander Kain, and James Hines. *"Evolutionary Algorithm: Metaphor for Learning."* In Genetic and Evolutionary Computation Conference. 2000. Las Vegas, NV: Morgan Kaufmann.

[Kerr 1975] Kerr, Steven "*On the Folly of Rewarding A, While Hoping for B"* Academy of Management Journal Vol. 18, No. 4 (December 1975), pp. 769-783

[Leon-Garcia 1994] Leon-Garcia, Alberto. *Probability and Random Processes for Electrical Engineering.* Massachusetts: Addison-Wesley, 1994.

[Mitchell 1999] Mitchell, Melanie. *An Introduction to Genetic Algorithms.* Cambridge, MA: The MIT Press, 1999.

[Senge 1990] Senge, Peter M., *The Fifth Discipline: The Art and Practice of the Learning Organization*, Currency Doubleday, 1990

[Sterman 2000] Sternman, John D., *Business Dynamics: Systems Thinking and Modeling for a complex world*, McGraw-Hill Higher Education, 2000.

[Walpole 1989] Walpole, Ronald E, and Raymond H. Myers. *Probability and Statistics for Engineers and Scientists*. New York: Macmillan Publishing Company, 1989.